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Appel pour l'achèvement du Système du Monde de Duhem

Dans la pensée du regretté PIERRE DUHEM (1861-1916), son grand ouvrage « Le système du monde. Histoire des doctrines cosmologiques de PLATON à COPERNIC » devait comporter une dizaine de volumes. Au seuil du premier volume il écrivait : « L'œuvre dont nous entreprenons aujourd'hui la publication aura de vastes proportions, pourvu que Dieu nous donne la force de l'achever ». Grâce au désintéressement des éditeurs, MM. A. HERMANN et fils, et aux subventions de l'Institut de France et du Ministère de l'Instruction publique, le premier volume parut en 1913. Les volumes suivants parurent respectivement en 1914, 1915, 1916. DUHEM mourut le 14 septembre de cette année. La régularité de la publication ne fut pas immédiatement interrompue, et le tome V parut en 1917, d'ailleurs sans un mot annonçant la mort de l'auteur, ce qui suggère que lui-même en avait lu les épreuves finales.

Dans sa récente biographie de son père Mademoiselle HÉLÈNE PIERRE-DUHEM (1) nous dit (p. 236) :

« Depuis dix-huit ans les quatre derniers tomes du *Système du monde*, complètement achevés à sa mort, attendent toujours de pouvoir paraître. » Si ces volumes VI à IX de la grande œuvre de DUHEM sont vraiment prêts à être imprimés, c'est presque un scandale de les laisser inédits. Nous pensons qu'il importe de les publier et de donner au monde savant ces instruments de travail précieux à la préparation desquels ce grand physicien et ce grand érudit avait consacré les dernières années de sa vie. Ces volumes sont consacrés au quatorzième siècle pour lequel

(1) Un savant français, PIERRE DUHEM. Préface de MAURICE D'OCAGNE. XVI + 240 p., port. Paris, PLON, 1936.

il avait une curiosité et une affection toutes spéciales, et au quinzième siècle qu'il aimait moins, mais qu'il avait sans doute exploré avec la même application. Il importe aussi de les publier rapidement car chaque année qui s'écoule risque de diminuer leur nouveauté et de faire oublier ses droits de priorité.

Nous espérons de tout cœur que les corps savants tels que l'Académie des sciences, l'Académie des inscriptions et l'Académie internationale d'histoire des sciences s'uniront à nous pour demander que la publication du *Système du monde* soit achevée le plus vite possible.

Ces volumes VI à IX pourraient être publiés dans le même format et au même prix relatif que les volumes précédents, et sans doute par le même éditeur. Nous prions instamment les lecteurs d'*Isis* qui s'intéressent à cette œuvre fondamentale de nous envoyer de suite leur adhésion et ainsi de faciliter et d'accélérer la publication. Si nous pouvions réunir un minimum de trois cents souscriptions, la publication serait assurée.

Notre rôle est tout à fait désintéressé, ou plutôt nous n'avons d'autre intérêt que celui de faire progresser l'histoire des sciences. Nous nous bornerons donc à recueillir les souscriptions et à les transmettre à l'éditeur éventuel.

Cambridge, Massachusetts, 22 octobre 1936. GEORGE SARTON.
Paris, 9 novembre 1936. M. P. TANNERY.

A Hindu decimal ruler of the third millennium

(Second note)

In my first note bearing the same title (*Isis* 25, 323-26, 1936) I regretted my inability to publish a photograph of that remarkable object and the lateness of my report, both being due to the fact that I had written on Nov. 8, 1935 to Mr. ERNEST MACKAY and waited indefinitely for an answer that never came.

However having heard that a plaster cast had been presented to the Science Museum, South Kensington, I applied for a

Indian Linear Measure in shell from Mohenjodaro, c. B. C. 3000.
Fragment showing $\frac{1}{2}$ unit sub-divided into 5 parts

photograph of it. Thanks to the courtesy of the Museum and of two of its officers, H. R. CALVERT and F. G. SKINNER, I am able to reproduce that photograph. The label, prepared by Mr. SKINNER, in charge of the metrology section, reads as follows. It should be noted (1) that the measurements were made by him (on the plaster cast) before having seen Mr. MACKAY's account or my own; (2) that in the printed label, the last words but one of the first line read " in stone," a mistake which has been corrected in handwriting to " in shell."

Indian Linear Measure
c. B.C. 3250-2750
(Mohenjodaro)
Cast presented by
The Archaeological Survey of India

This fragment of a measuring rod, in shell, is the only linear measure found at Mohenjodaro, the site of an ancient pre-Aryan civilisation that built several large cities with fine stone buildings along the valley of the river Indus in N. India.

This fragment from one end of the rod, shows the zero of the scale, indicated by a circle, and 7 subdivisions, of which 5 make the next larger unit as shown by the large dot on the 6th line from zero. It is remarkably accurately divided, the mean subdivisions = 0.264 in. $\pm$ 0.005 in. Five sub-divisions = 1.32 in. (33. 55 mm.). Assuming a decimal multiplication, as usual in many Indian measures, this gives a major unit of 13.2 in. (335.5 mm.), which agrees with the Northern Foot, the most widespread of ancient linear units, which survived in Europe until recently displaced by the metric system. (See Inv. 1931—461 and 462, Ancient Egyptian Measures of this unit.)

Inv. 1936—351.

October 24, 1936. GEORGE SARTON.

Date of the translation by Ermengaud Blasius of the work on the quadrant by Profatius Judaeus

The year 1299 A.D. has been accepted by PIERRE DUHEM (1) and by G. BOFFITO and C. MELZI D'ERIL (2) and the earlier authorities whom they cite as the date of the Latin translation at Montpellier by ERMENGAUD BLASIUS (3) of the work on the quadrant by PROFATIUS JUDAEUS. This version opens, " Quoniam scientia artis astronomie non completur absque instrumentis...", whereas the other Latin version, described as the treatise of the new quadrant composed in 1288 and corrected by PROFATIUS himself in 1301, has the incipit, " Cum stellarum scientia sine instrumenits congruis minime compleatur..." This second version is somewhat more common in the manuscripts. Incidentally it may be noted that the assertion of DUHEM, " Le texte hébreu de cette seconde édition nous est connu," has been corrected by BOFFITO and MELZI D'ERIL who have stated that there is no Hebrew manuscript of it, that the original Hebrew text is irreparably lost, and that the Hebrew text now extant was translated from the Latin (4). Indeed, there seems reason for believing that PROFATIUS himself issued his revision of 1301 in Latin.

(1) *Le système du monde*, III (1915), 307-8.

(2) *Il quadrante d'Israele. Testo Magliabechiano del sec. XIV descritto trascritto illustrato*, Florence, 1922, p. 15.

(3) Concerning different spellings of this name see further my *History of Magic and Experimental Science*, II (1923), 845, note 2. In the *Cartulaire de l'Université de Montpellier*, ed. A. GERMAIN, II, 856-7, is the form, " Ermengaud Blezin." PANSIER in *Janus*, IX (1904), No. 16 gives, " Armengaldus Blasii." PANSIER further accepts 1299 as the date of translation but makes the curious statement that ERMENGAUD " traduit avec le concours du juif PROFATIUS (JACOB BEN MAKIR) un traité de géométrie sur l'arc de cercle déjà traduit de l'arabe en hébreu," for which his only reference is the vague one, " MS. de la bibl. d'Oxford no. 340," which probably means Canon. Misc. 340.

(4) *Op. cit.*, p. 16.

Returning to the question of the year 1299 as the date of ERMENGAUD BLASIUS's translation, it may be said that the chief basis for it appears to be a manuscript of the fifteenth century which formerly belonged to the abbot Canonicus of Venice and is now at the Bodleian in Oxford : Canon. Misc. 340, fols. 109-120. It may be noted that this manuscript, or at least the notice of it in H. O. COXE's catalogue (5) gives the verb in the incipit above quoted as *complectitur* rather than *completur* which suggests that there may at some time or other have been a similar miscopying of the date of translation. Moreover, both DUHEM and BOFFITO and MELZI D'ERIL recognize that the dates 1290 and 1293 appear in connection with this Latin version, although they associate these dates as alternatives for 1288 as the time of the first composition by PROFATIUS rather than with the Latin translation by BLASIUS. But from BOFFITO and MELZI D'ERIL's own description of the manuscripts it seems clear that 1290 is given as the date of translation both in Paris, Bibliothèque Nationale, Latin MS 7437, 15th century, fol. 155v *et seq.*, and in Erfurt, Amplon. F. 394, early 14th century, fols. 130v-135r, " Inc. tract. Prof. de Marcilia Hebrei sup. quadr. translatus ab Hebreo in Latinum apud Montempessolonanum anno incarnacionis Domini 1290 " (6). It is true that ERMENGAUD BLASIUS is not mentioned as translator in either of these notices, though he perhaps may be in the manuscripts themselves, but the incipit in either case is that of his version and in the second case the place of translation is given as Montpellier. It will further be observed that one of these manuscripts is earlier than Canon. Misc. 340.

Now I wish to add a third manuscript not mentioned by BOFFITO and MELZI D'ERIL which clearly ascribes the translation to ERMENGAUD BLASIUS and dates it in 1290 both at the beginning and end of the text. Milan, Ambros. N. 9. Sup., 14th century, parchment, fols. 129r-139r : rubric, " Incipit tractatus PROFATII de Massilia hebrei super quadrante translatus de hebreo in latinum a Magistro ARMENGANDO BLEBLESINI *(sic)* iuxta vocem eiusdem

(5) HENRICUS O. COXE, *Catalogi codicum manuscriptorum bibliothecae Bodleianae pars tertia codices Graecos et Latinos Canonicianos complectens*, Oxford, 1854.

(6) I quote this not from BOFFITO and MELZI D'ERIL but directly from WILHELM SCHUM, *Beschreibendes Verzeichniss der Amplonianischen Handschriften-Sammlung zu Erfurt*, Berlin, 1887.

apud Montem pess. M° CC° 90° annum *(sic)* domini nostri Iehu Christi "; incipit, " Quoniam scientia artis astronomie non completur absque instrumentis..."; the text as usual consists of 16 chapters and ends, " ... ubi cadet signum in linea factum ibi est locus stelle. Explicit tractatus super opus quadrantis editus a Magistro PROFAIGH de Marsilia Iudeo sapiente astronomo annis domini nostri Iehu Christi -M° CC° 90°." If we had this explicit alone, we might take the date 1290 as that of the work's composition by PROFATIUS, but the initial rubric makes clear that it is the time of translation by ERMENGAUD.

Thus the weight of the manuscript material available seems to favor the date 1290. Moreover, the general probabilities would also seem to favor it. The work of PROFATIUS on the quadrant seems to have had a very favorable reception. It was translated by BLASIUS, then it was revised in 1301 by PROFATIUS himself, then in 1309 came another revision by PETRUS DE SANCTO AUDOMARO (PIERRE DE ST. OMER), chancellor of Notre Dame, Paris. Since in the revision of 1301 PROFATIUS is spoken of as composing the work in 1288 at Montpellier, it would seem more natural for it to be translated there in 1290 than in 1299. Moreover, if only two years elapsed between ERMENGAUD's translation (in 1299) and PROFATIUS's revision in 1301, one would hardly expect to find so many manuscripts of ERMENGAUD's translation, which would have been almost immediately superseded by the author's revision in Latin. But if we allow eleven years between the two, the circulation of the work will explain both the survival of a number of copies of ERMENGAUD's translation and the desirability—by 1301—of Profatius's issuing his revision directly in Latin.

So far as the career of ERMENGAUD BLASIUS himself is concerned, either date would seem equally available for such a translation. The affair of his promotion from bachelor to master of medicine by the official of the bishop of Maguelone, after he had failed in the examination for that degree, and the appeal of the university of Montpellier to pope NICHOLAS IV occurred in 1289-1290 (7). It can scarcely be argued from his failure to pass in medicine that he was not yet qualified to translate a work on the quadrant.

(7) *Cartulaire, loc. cit.*

Indeed, his translation of the *Cantica* of AVICENNA with the commentary of AVERROES from Arabic into Latin is dated by PANSIER in 1284 (8) and by a Peterhouse manuscript at Cambridge in 1283 (9). But since it calls him a master in medicine, the date is perhaps open to suspicion. In 1294, according to a Gonville and Caius manuscript, he translated at Montpellier the work of MAIMONIDES on regimen of health and especially on asthma but did not publish it until 1302 (10). In 1305 he attended JAMES II of Aragon, until ARNALD OF VILLANOVA returned and relieved him in April (11). In 1307 he translated MAIMONIDES on poisons for pope CLEMENT V (12). STEINSCHNEIDER called him the physician of PHILIP the Fair (13).

Columbia University,
New York City.

LYNN THORNDIKE.

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(8) PANSIER, *loc. cit.*

(9) PETERHOUSE 101, 13th-14th century, No. 11 : " Expicit *(sic)* translacio canticorum avicenne cum commento averroys facta ab arabico in latinum a mag. ARMENGANDO BLASII de monte pessulano magistro in medicina anno incarnacionis verbi M° CC° lxxxiii deo gratias."

(10) Cambridge University, Gonville and Caius College 178, 14th-15th century, fols. 130-165 : " Explicit liber raby moyses egipcii et de regimine egrorum et sanorum et specialiter de asinate (asmate ?) cum nequid perfectum medicum invenire translatus ab arabico in latinum apud montem pessulanum a mag. ARMENGANDO blazini mediante fideli interprete. Anno domini M° CC° nonagesimo quarto et communicatur per eundem anno domini M° ccc. ii. in mense maii deo gracias."

(11) P. DIEPGEN, " ARNALD VON VILLANOVA als Politiker und Laientheologe," *Abhandl. z. Mittl. u. Neuer. Gesch.*, Heft 9 (1909), p. 42.

(12) Manuscripts are : at Oxford, Corpus Christi College 125, fols. 1r-13v; at Cambridge, Peterhouse 101, 13th-14th century, No. III "Explicit liber RABYMOISES cordubensis translatus barthinone a mag. hermengaldo blesii in honorem reverentissimi summi pontificis CLEMENTIS quinti anno ab incarnacione verbi 1307."

(13) " Die Europäischen Uebersetzungen aus dem Arabischen " *Sitzungsberichte d. kais. Akad. d. Wiss. in Wien Philos.-Hist. Klasse* Bd. 149 Heft 4 No. 19 or p. 6.

Introduction and canon by Dalmatius to tables of Barcelona for the years 1361-1433 A.D.

In Berne 227, a fifteenth-century manuscript of quarto size written on paper, which in 1472 belonged to a doctor BARBATUS, is an introduction to astronomical tables composed during the fourteenth century. PETER III OF ARAGON had summoned to Barcelona two astronomers, PETRUS ENGISBERTI DE RUCHERNA, master of arts, and his pupil, DALMATIUS, to draw up new tables of the true places of the planets. They set to work, not trusting in past books but employing very large armillae and many other great and sumptuous instruments, some of which were sixteen cubits and more in diamater and some less, and carrying out painstaking observations of both planets and fixed stars by day and night over a long period. The work was begun on January 1, 1360 and terminated towards the end of 1366. PETRUS ENGISBERTI died before it was completed but his disciple, DALMATIUS, carried the work to conclusion. It is he who writes the introduction to the tables setting forth these facts. He also quotes the Bible, PTOLEMY and other authors in support of astronomy and astrology.

The tables are not found in our manuscript. DALMATIUS tells us that they covered some sixty years to 1433 and were drawn up for the meridian of Barcelona whose latitude he gives as 41 degrees and longitude as 33. The tables gave the true conjunctions and oppositions of sun and moon, the true place of the sun and moon, also the true places of the other planets and of the head of the dragon, finally the center, portion and latitude of the moon and the parts of its ascension and descent with its position north or south. Last, the centers and portions and latitudes and parts north and south, also the parts of ascension and declension of Saturn, Jupiter, Mars, Venus and Mercury or the said sixty years and the months and the days of each

month. DALMATIUS states that the tables of AZARCHEL and ALPHONSO X require amendment with time, that copies of them are corrupt and full of mistakes, making all past tables uncertain.

This introduction of DALMATIUS is illuminating in more than one respect. It shows that medieval Latin astronomical tables were not always at least based upon previous ones and merely revised without much new observation. DALMATIUS testifies to new tables, a century after the Alphonsine, based on six years of elaborate and careful observation of the heavens. Furthermore these observations were made with a wealth of large instruments. I have elsewhere noted how JEAN DE MURS in 1318 observed the vernal equinox with a *kardaja* with a radius of fifteen feet (1), whereas the mural quadrant of TYCHO BRAHE at the close of the sixteenth century had a radius of only six feet, nine inches. Now we hear of use of instruments more than sixteen cubits in diameter later in the fourteenth century from 1360 to 1366. Nor was this the first time that such astronomical observations had been made by orders of a king of Aragon at Barcelona. In 1302 " a great astrologer whom the king of Aragon compensated for doing this " had corrected the position of the stars by observations made at Barcelona with two large armillaries (2). The Latin text of DALMATIUS's Introduction and Canon to the Tables follows.

" Dicit qui tenet 7 stellas in dextra sua etc. Scio opera tua," *Apocalypsis* 2°. Ptolomeus vir in scientia stellarum peritissimus exorator *Centilogii sui propositione quinquagesima* sic ayt, " Non obliviscaris causam 120 coniunctionum que sunt in stellis erraticis. In illis enim est maior scientia eorum que fiunt in hoc mundo." Ex quibus verbis clarum deducitur quod scientia potior effectuum sive operum que in hic mundo fiunt a stellis erraticis quas nos septem planetas vocamus descendit (?). Ex quibus verbis trahitur hec proposicio satis clara quod scientia eorum que in mundo fiunt a 7 stellis erraticis quas planetas dicimus acquiritur et habetur. dicti autem racio ex *Epistola* Messallach de planetarum efficacia colligitur qui sic inquit : " Dominus deus altissimus fecit terram ad similitudinem spere, fecit circulum altiorem in circuitu eius

(1) *A History of Magic and Experimental Science*, III (1934), 294.
(2) *Ibid.*, p. 295.

volubilem et posuit terram immobilem in medio celi et non declinantem neque ad dextram neque ad sinistram. Posuit elementa mobilia et moveri fecit ea per motum septem planetarum. Capud vero draconis et signa et universe stelle participantui septem planetis in operibus suis atque naturis. Simile ergo est planetarum opus in hoc mundo lapidi magnetis quia sicut atrahitur ab hoc lapide ferrum per notam longitudinem its omnis creatura et universa que sunt super terram tam semen quam aliud fortuna sive impedimentum aptacio sive destruxio fit et ex motibus planetarum et operibus eorum." Hec ille. Et advertendum *Genesis* 2° quod deus antequam animantia fecerit fecit duo luminaria magna luminare maius ut preesset diei et luminare minus ut preesset nocti et stellas. Et posuit in firmamento celi ut lucerent super terram ut preessent diei ac nocti. Ex quibus pandere voluit quod licet species id est pulcritudo celi a gloria stellarum refulgeat, ut sapiens ayt, non solum ex hoc condite (3) sunt sed ut lumen prebeant in suo lumine influentes (4) istis inferioribus et terrenis. Nec solum accionibus pure naturalibus influunt sed et quibusdam que apparent esse humane sive a libero arbitrio procedentes ut sunt pugne et prelia sive bella, prout illa sancta prophetissa Delbora victo et interfecto Sizara principe milicie exercitus Iabin regis Canaan sentire videbatur cum dixit: " Pugnaverunt reges Chanaan in Chanana iuxta aquas moriendo et tamen nichil tulere predantes. De celo dimicatum est contra eos stellis manentibus in ordine et cursu suo adversus Sizaram pugnaverunt." Ac si aperte diceret, " Pugnaverunt reges Chanaan et nullam predam tulerunt quia non victores sed victi fuerunt." Et racio fuit quia stelle manentes in ordine et cursu suo pugnaverunt contra eos, quasi dicat quod istis victoria percussio et cursu stellarum et ordine provenit, neque mirum quia virtutes hominis tam pure naturales quam et irascibilis et concupiscibilis et appetitiva que et ad bella communiter movent et in viro virtuoso et accioni subduntur a 7 planetis originem trahunt unde Ptolomeus dicti *Centilogii propositione vii* sic ayt, " Sol est origo virtutis (fol. 40v) vitalis, luna est origo virtutis naturalis, Saturnus est origo virtutis retentive, Iupiter virtutis crescentis, Mercurius (5)

(3) *Candite* in the MS.
(4) *Influantes* in the MS.
(5) *Marcis* in the MS.

virtutis cogitationis, Mars virtutis nascendi et attrahendi, Venus virtutis appetitive. Igitur operationes a talibus virtutibus emanentes non est dubium a dictis 7 stellis erraticis sive planetis tamquam a causis universalibus emanare, prout autem Aristoteles in suis antelogicis contestatur. " Rerum scientia dupliciter habetur vel per effectus in quibus universaliter proprie cause relucent, et hec scientia dicitur minus potissima sive a posteriori. Vel per causas que suos effectus virtualiter continent et ipsos in se efficaciter re representant, et hec scientia a priori et potissima appellatur."

Stelle vere ut in superioribus est deductum effectus dei sunt et cause horum inferiorum, igitur ipsis stellis cognitis hebetur scientia dei et operum que deus in hoc mundo ipsis mediantibus operatur. Unde quidam ex antiquis philosophis in tractatu quodam de commendacione scientie superiorum corporum sic ayt : " Astrorum sciencia per corporum immensitatem creatoris ostendit potenciam, per decorem et ordinem gubernatoris sapientiam, per utilitatem universorum rectoris benignitatem sive clemenciam ut ab inicio creature dictum sit, ' Celi enarrant gloriam dei signis scilicet et ymaginibus et stellis, et opera manuum eius annunciat firmamentum.' Cum rerum historiam in ipsius spere celestis ymaginibus et signis ab inicio designant et fere quisquis astrorum posset habere scienciam et motus eorum et motuum et effectus cognosceret veritatem ubi videret legeret et intelligeret ut in libro." Hic (6) ille. Propterea altissimus qui semper meliora prospicit precunctis sanctis nolens hanc a mortalibus adipisci antiquis predecessoribus nostris ut tradunt theologi ex hoc vitam prolixiorem contulit et per experientiam motus cursusque syderum que non nisi longo tempore perficiuntur investigantes agnoscerent agnitos in scripturis redigerent et de hiis posteros edocerent ut sic non solum ad corruptibilium noticiam devenirent. Sic enim ille sententiarum philosophus earum (7) ut ipse in sua phisica et metaphisica metheorica tradit non tantum cognicionem motuum et mutacionem naturalium sed esse spiritus quod intelligentias vocat et unum principem et principium immobile et movens omnia evidenter conclusit. Sic Ionicus illius iusti Noe filius prout narrat Iosephus

(6) *Hec?*
(7) *Sententiorum... eorum* in the MS.

celibem et segregatam ab hominibus vitam ducens hanc adeptus. Nembrot eam docuit et ipsum primum per hanc ad regnum solus sublimavit. Ille sanctus patriarcha Abraham voce lapsa divinitus, " Suspice in celum et numera stellas," *Genesis* 15°, qui in stellarum scientia ut magister narrat plenissime eruditus ipsam in egipticos et in successores proprios copiose transfudit. Et quid dicam amplius? Nonne Salomoni pre cunctis regibus sapientia insignito hanc specialibus ipsemet gloriose infudit uti quod unde *Sapientie* 7° ipse de se loquitur in hunc modum. " Deus," inquid, " dedit michi horum que sunt scienciam veram ut sciam dispositionem orbis terrarum et virtutes elementorum initium et conservationem et medietatem temporum vicissitudinem permutationes et conservaciones temporum anni cursus et stellarum dispositiones. Ex quo qui recte considerat cetera pre- (fol. 41) cedentia descendunt." Hinc ille astrologorum maximus Ptolomeus *quadripartiti sui libro primo capitulo* 3° sic ayt, " Dicemus namque inquid quoniam si huius sciencie utilitatis quantitatem que ad animam pertinet considerare velimus deprehendimus nichil esse a quo esse alacritates que anime causatam melioracionem assumant universalitatemque nec esse in quo tantum lucratur anima sicut in huius sciencie prenosticacione per ipsam et enim ad divinarum humanarumque rerum notitiam pervenimus corporis item utilitas quoniam ad ea que cuique complexioni competunt pervenire nequimus nisi per huius operis cogitacionem. In divitiis autem et dignitatibus ac in hiis similibus id dicere possumus quod in tota philosophia consideramus.

Nec prodest solum stellarum scientia ad bona quod dicta sunt consequenda sed etiam ad iuvanda mala que ex horum ignorantia possunt de facili evenire. Unde idem Ptolomeus supra allegati *centilogii propositione* (8) 7*a* dicit, " Astrologus optimus multa mala prohibere poterit quod secundum stellas venturum est cum eius naturam presciverit. Sic enim premuniet eum cui malum futurum est ut posset illus pati. Ex hoc claudere possimus quod cum per 7 stellas erraticas quas 7 planetas nuncupamus et eorum que fiunt et ut dicam verius que sunt veram scienciam habeamus ne solum presentium verum etiam plurimum futurorum ut ex precedentibus patet. Qui tenet 7 stellas in dextera sua hoc est

(8) *Proporcione* in the MS.

qui planetarum motuum oppositionum coniunctionum aspectuum et aliorum ad ipsos pertuentium pre manibus scientiamque cause cuiuslibet dicere poterit, Scio opera tua, que verba in modo principio (9) fuerunt assumpta.

Quibus consideracionibus illustris dominus et princeps magnificus Petrus rex Aragonum tertius promotus non tamen familiari et proprie sed pocius rei publice utilitati consulens attendens scienciam verorum locorum et motuum dictorum 7 planetarum hiis temporibus pre manibus et veridice non haberi et per consequens eorum opera non poterant sic cum veritate sciri licet ad hoc plures actorum dedissent efficacem prout longe ante adventum Christi fuit Abraxis et paulo post Ptolomeus ut quidam asserunt rex Egipti et in hac sciencia summus qui super hiis composuit tabulas et volumina plura. Et post Christi adventum Azarchel vir potens et magnus supra Tholetum alias tabulas composuit que Tholechane dicuntur. Et idem fecit fieri istis temporibus novissimis rex Castelle Alphonsus unde et eius tabule Alphonsine adhuc appellantur. Et licet Alphonsium omnis predictarum propriores sint veritati, nichilominus emendacione tripliciter egent quod hic causa brevitatis enucleare dimittendum est. Ach etiam plures alii ad ydem laborantes diutius insudassent propter tamen lapsum temporum et velocitatem motuum et librorum corrupcionem que sepius scriptorum vicio contingunt *(sic)* ut tactum est de premissis vix aut nulla existet certitudo et illudmet non sine difficultate avertens insuper quod in omni scientia semper postremi qui docta priorum viderunt et ex proprio ingenio aliquid invenerunt pleniori et perfectiori et ordinatiori modo et etiam breviori enucleant veritatem prout decet magnificentia (fol. 41v) regina hec enim sciencia proprie regum est magistrum Petrum Engisberti de Connchena magistrum in artibus et in astrorum scientia peritissimum et Dalmatium Planes de Propeniani habitatorem in dicta sciencia eruditum apud Barchinone civitatem utique antiquam et ubique celebrem et famosam convocavit. Quibus iussit ut dicta loca vera ipsorum planetarum perquirerent diligenter et inventa in scriptis reponerent ad memoriam sempiternam. Quibus de locis expedientibus et expensis ad tale opus necessariis provideri fecit iuxta munificentiam

(9) *Primitivo?*

principalem. Quidquidem mandatum regum exequentes de libris veterum non confisi cum armillis permaximis et aliis magnis multis et sumptuosis instrumentis numero 13 quarum quedam 16 cubitos et ultra in dyametrum quedam est quedam minus habeant per multa et magna tempora nocte et die inspectantes diligentissime loca vera dictorum planetarum et stellarum fixarum non sine multis laboribus et vigiliis invenerunt et per modum infra contentum notaverunt. Licet dictus magister Petrus morte inceptus perficere non potuerit, dictus tamen Dalmatius discipulus ipsius et in ipsa sciencia expertus opus complevit primo sub certis tabulis deinde in modum almanticum aliis in ipsis tabulis seu almanco predictis contentis loca vera et alia describendo prout in ipsorum canone inferius posito plenius continetur. Fuit autem inchoatum opus predictum anno domini Ihesu Christi 1360 perfecto prima die mensis Ianuarii et perfectum anno dicti domini Ihesu Christi 1366 circa finem ipsius anni annique a nativitate predicti domini regis 47 ordinacionis vero ipsius 30 ad honoıem predicti domini Ihesu nostri Ihesu Christi et beatissime virginis Marie matris eius et omnium sanctorum et supradicti illustris domini regis Petri cuius vita et imperium adaugea dominus in eternum.

Causis et rationibus huius operis in precedenti prohemio reseratis restat ut canonem in quo libri continentiam et procedendi ordinem modumque operandi ostendamus. Est autem sciendum quod opus istud currit pro nunc a 1360 anno domini exclusive usque annum eiusdem domini 1433 inclusive ex quo patet quod hoc opus solum ad 60 annos extenditur de presenti. Sed vita prefati illustris principis mei in hoc opere ipsius indigni servitoris sive predictum opus amplius dilatare postea sub certis regulis ipsum perpetuare. Est autem factum ad meridiem civitatis Barchinone cuius latitudo est 41 gradus longitudo vero 33. Et continet coniunctiones veras et oppositiones solis et lune et verum locum eius solis et lune vera etiam loca aliorum 5 planetarum et capitis draconis deinde centrum porcionem latitudinem etiam lune et partes ascencionis et descencionis cum meridionalitate et septentronalitate ipsius. Ulterius centra et porciones et latitudines et partes septentronalitatis et meridionalitatis necnon partes ascencionis et descencionis Saturni Iovis Martis Veneris et Mercurii (10) ad annos predictos 60

(10) *Martis* in the MS.

et ad menses diesque mensium singilorum etc. (fol. 42r).

Et ne miretur quispiam cur ego de centris porcionibus latitudinibus planetarum et quibusdam aliis in hoc opere curavi cum alii similia opera fecerunt de talibus nunc fecerunt mentionem, erit sciendum quod omnes planete excepto sole habent 4 status. Primus est in zodiaco et hic est verus locus et computatura capitis arietis et ostendit in quo signo et in quo gradu signi in zodiaco planeta existat. Et per istum statum possumus scire utrum planeta sit in aliqua sui dignitate vel alterius planete aut non. Item per hunc modum scimus oppositiones et coniunctiones et alias aspectus. Item utrum sit occidentalis vel orientalis quia si distent ultra 6 signa a sole sunt orientales si minus sunt occidentales. Secundus status planete est in suo deferente et vocatur centrum et per istum scimus de centro epicicli utrum sit altum in suo deferente vel non. Et si ascendit ad augem vel descendit et computatur ab (11) auge deferentis. Et quanto centrum est altius in suo deferente tanto planeta est potentior illo qui est in inferiori parte deferentis. Et planeta ascendens ad augem potentior est quam sit planeta ab auge descendens. Unde quando centrum est a 9 usque ad 12 tunc est planeta in sua maiori fortitudine quia tunc est ascendens et est in superiori parte sui deferentis. Et quando centrum est a 0 usque ad 3 signa tunc planeta est fortis sed non tantum quia quamvis sit in superiori parte deferentis est tamen descendens ab auge. Et quando centrum est a 3 signis usque ad 6 tunc est planeta debilis sed non tantum quia licet in inferiori parte deferentis (12) est tamen ascendens ad augem. Tertius status planetarum est in epiciclo et vocatur augmentum vel porcio et computatur ab (13) auge epicicli et per istum scimus fortitudinem et debilitatem quam habet planeta in epiciclo. Quia quando porcio est a 9 signis usque ad 12 tunc est in maiori fortitudine in quo possit esse in epiciclo. Et quando est a 0 usque ad 3 signa, est fortis sed non tantum. Et quando est a 3 signis usque ad 6 est debilis quantum potest esse. Si tamen est a 6 signis usque ad 9 est debilis sed non tantum et hoc propter rationes dictas superius de deferente propter hoc habent planete in epiciclo

(11) *Ad* in the MS.
(12) *Differentis* in the MS.
(13) *Ad* in the MS.

retrogradacionem et direccionem. Quia quando fert in inferiori parte epicicli fert retrogradi. Quando fert in superiori fert directi excepta luna que quando est in inferiori parte tunc dicitur quiescens in motu. Quando autem est in superiori dicitur minuens in motu et alteram direccionem vel retrogradacionem non habet. Quartus status vero latitudo et computatur ab ecliptica et per istum scimus si planeta est septrionalis vel meridionalis et sive descendens vel ascendens ad meridiem vel ad septentrionem. Quia si latitudo est septentrionalis et numerus currit crescendo, tunc ascendit ad septentrionem. Si decrescendo, descendit ad septentrionem. Et si latitudo est meridionalis et numerus augetur tunc, tunc ascendit ad meridiem. Si minuitur, descendit vel cadit ad (14) meridiem. Et quando est septentrionalis ascendens, tunc est in maiori fortitudine quam esse possit in hoc statu. Et quando descendit a septentrione, est fortis sed non tantum. Et quando est ascendens ad meridiem, tunc est in debiliori virtute quam possit esse in isto statu. Sed si sit descendens, est debilis sed non tantum. Hec ideo dixi ut scias quare posui centra (fol. 42v) porciones latitudines ut sic fortitudinem sive debilitatem planetarum posset de facili reperire. Sunt hec enim valde necessaria ad iudicia ad que hec sciencia ordinatur etc.

Modus autem procedendi talis est quod annis supradictis in superioribus libri huius marginibus expansis in marginali sinistro latere anni cuiuslibet menses singuli describuntur. Ante quos tendendo ad destram reperies tabulam per columpnas xv secundum xv dispositiones motus et situs planetarum prout huis operi congruit condivisam cum titulis et annotationibus competentibus columpne cuiuslibet prenotatis.

Prima autem columpna oppositiones et coniunctiones solis et lune continet prout quolibet mense contingunt diem et horam et minutum in quibus sunt persubscriptos eis numeros designando. Secunda divisa a summo usque ad deorsum per 8° inrestitia prout sunt omnes alie subsequentis que cellula nuncupatur dies enumerat cuiuslibet mensis per ipsam expansas. Tertia (15) verum locum solis quo ad signum gradum et minutum per 3 numeros in ordine transversali positos clarius designat ut sic primus

(14) *A* in the MS.
(15) *Tertius* in the MS.

ordo numerorum numero prime diei respondeat ad meridiem dicte civitatis. Et secundus ordo diei secunde et tercius tercie et quartus quarte et ceteris descendendo. Quarta verum locum lune describit modo et tempore quo dictum est de sole. Quinta aliorum 5 planetarum verum locum insinuat sed aliter quam precedentes. Nam quelibet cellula que 4° dies solummodo respicit et numerorum ordines apprehendit superius signum gradus minutum in quo saturnus et secundus in quo Iupiter tertius in quo mars quartus in quo venus quintus in quo mercurius sicut veraciter describit non tamen ad meridiem diei cuiuslibet sed tantum diei ultimi in cellula vel cella columpne dierum et respondente cellule et numerorum ordines continenti ut sic locus verus planete scriptus in prima huius columpne cellula respondeat quarte diei. Et scriptus in quarta cellula quarte diei et ceteris semper per dierum quartenarios descendendo excepta ultima que ultime quotaque fuerit. Que ostendit per numerum in cellula obiecta dyametricaliter cellule diei de qua queris contentum. Sexta exprimit locum verum capitis draconis ad meridiem tamen diei quarte seu ultime in tali cellula posite eo modo quo dictum est de 5 planetis. Septima vero centrum lune. Octava porcionem. Nona latitudinem. Decima partem latitudinis per singulos numerorum ordines singulis diebus eo modo quo de vero loco solis vel lune supra dictum est ad meridiem diei cuiuslibet evidenter ostendentis. Undecima autem centra. Duodecima porciones. Tertiadecima latitudines, Quartadecima partes 5 aliorum planetarum planetis singulis singulos ex 5 numerorum ordines in qualibet cellula inclusos adaptando ad meridiem quarte diei in cellula dierum de directione opposita prout de vero loco earum permissum est delucidant et declarant. Quintadecima exponit clarius premissorum latitudinem assendentia et dessendentia sicut in ipsa invenies denotata.

Cum igitur operari volueris, quere annum et menses et diem quoque cuiuslibet mensis de quo scire cupis adagnoscere predictorum et in directum diei illius que id quod queris reperies annotatum prout supra extitit declaratum. (fol. 43r). Quibus 5 planetis est addenda eciam motus axi octave spere quod est pro quolibet anno 28 secunda 14 tertia. Sed quia in isto opere non sunt secunda neque tertia adde in duobus annis unum minutum usque ad 20 annos. Quod facias per modum quod sit tota addicio

9 minuta sive plus et 24 secunda 40 tertia nisi ponere possis secunda neque tertia. Item a vero motu lune semper minue 5 gradus 47 minuta. Et hoc accidit ex errore radicis medii motus lune etc.

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Faust and Johann Virdung of Hassfurt

The interest of the astrologer, JOHANN VIRDUNG of Hassfurt, in occult arts is shown not only by such incidents as his visit to England in 1503 " to learn magic," and a visit paid him in 1520 by NICHOLAS of Fairmount, a British nigromancer, but by his writing to TRITHEMIUS concerning another practitioner of magic, GEORGE SABELLICUS, who seems to have been the original of Faust (1). VIRDUNG's letter to TRITHEMIUS does not seem to be extant, but we have the latter's reply, published by RAYNALDUS under the year 1507 (2), in which he brands " master GEORGE SABELLICUS faustus junior " as a charlatan and impostor who asserted that he could parallel Christ's miracles but possessed no real knowledge. The Latin text of TRITHEMIUS follows :

" Homo ille de quo mihi scripsisti Georgius Sabellicus qui se principem necromanticorum ausus est nominare gyrovagus battologus et circumcellio est dignus qui verberibus castigetur ne temere deinceps tam nefanda et ecclesiae sanctae contraria publice audeat profiteri. Quid enim sunt aliud tituli quos sibi assumit nisi stultissima ac vesanae mentis inditia qui se fatuum non philosophum ostendit? Sic enim titulum sibi convenientem firmavit, Magister Georgius Sabellicus faustus junior fons necromanticorum astrologus magus secundus chiromanticus necromanticus pyromanticus in hydra arte secundus... Eadem vanitate actus in plurimorum fertur dixisse praesentia quod Christi salvatoris miracula non sunt miranda se quoque omnia facere posse quae Christus fecit quoties et quandocumque velit."

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(1) See *Handwörterbuch des Deutschen Aberglaubens*, II (1929-1930), 1270; KIESEWETTER in *Faust in der Geschichte und Tradition*, 1893 p. 12.

(2) RAYNALDUS *Annales ecclesiae* ad annum 1507 § 30 citing TRITHEMIUS, *Epistolae*, II, 48. I do not have access to an edition of the letters of TRITHEMIUS containing this. See also DU PLESSIS D'ARGENTRÉ, *Collectio judiciorum de novis erroribus*, 1755, fI, ii, 348.

An early friend of the Copernican theory: Gemma Frisius

As the various historians of the Copernican hypothesis have pointed out, discussions favorable to the new conception of the universe are limited in number throughout the larger part of the Sixteenth Century. Exclusive of REINHOLD and his *Tabulae Prutenicae*, the unusually full account of DREYER mentions but three statements of this nature during the decade from 1550 to 1560. Two of these occur in the prefatory epistles of JOHN FIELD and JOHN DEE in FIELD's *Ephemeris* for 1557, published in 1556 (1). The third account, also of this year, appears in the *Castle of Knowledge* of ROBERT RECORDE (2). To these three important references to the new theory, a fourth should be added (3), the *Epistola* which GEMMA FRISIUS wrote in 1555 for the *Ephemerides Novae* of IOANNES STADIUS (4).

So far as I have been able to determine, this contribution to the early history of the Copernican hypothesis has been generally neglected. It is mentioned at the close of the Eighteenth Century by ABRAHAM KAESTNER, but the brief note of this historian is restricted to a short quotation which describes the growing

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(1) *History of Planetary Systems*, Cambridge, 1906, p. 346.

(2) London, 1556, pp. 162 ff. DREYER (pp. 346-7), citing DE MORGAN, describes the account of RECORDE as being presented in the *Pathway to Knowledge*, 1551. Since neither of the two copies of this edition which I have seen mentions COPERNICUS or his theory, it is certain that DE MORGAN confused the *Pathway* with the *Castle*, where RECORDE does give an incomplete description of the hypothesis. The titles are similar in part, and the *Castle*, as in the *DNB*, has also been dated 1551. However, the *STC* lists no edition before 1556, the earliest I have examined or found in catalogues.

(3) The dedicatory epistle of the author of the *Ephemerides*, IOANNES STADIUS, perhaps should be considered as a fifth favorable discussion.

(4) The *Ephemerides Novae* were first printed in 1556, and later in 1559 and 1560. The accompanying reproduction is from the Library of Congress copy of the edition of 1560, published in Cologne.

popularity of the *Tabulae Prutenicae*, and a somewhat enigmatic comment that GEMMA FRISIUS thought regarding the tables based on the Copernican world order as later physicians thought concerning the circulation of the blood (5). KAESTNER is accurate to the extent of indicating the primary interest of GEMMA, that is, the tables of STADIUS and REINHOLD, but in keeping with later writers he gives no suggestion of the important discussion of COPERNICUS and his work which occupies the third and the initial lines of the fourth and last page of the *Epistola*.

As will be noted from the accompanying facsimile reproduction of this discussion, given as Figure 1, GEMMA FRISIUS is an unreserved and intelligent advocate of the heliocentric conception. He attacks the ancient astronomy because of its errors in the motion of Mercury, and its mistaken calculations of the vernal equinox. The hypothesis of PTOLEMY, which appears at first sight more probable than that of COPERNICUS, contains such absurd suppositions as that the stars move unequally in their circles. The older astronomer assumes that the three superior planets, when rising at sunset, or in opposition to the sun, are always in the perigee of their epicycles.

In defending COPERNICUS, GEMMA praises first his method of daily observations and geometrical demonstrations. The hypothesis of the motion of the earth and of the sun resting in the center of the world is contrary to opinion or expectation, but it is drawn from natural phenomena, and provides a reasonable conception which is correspondent to the motions of the stars.

(5) *Geschichte der Mathematik*, 4 vv., Goettingen, 1797, II, 610-611. The complete account of KAESTNER states: "Der Anfang vom GEMMA PHRYSIUS, Arzt und Mathematiker, Ermahnung an STADIUS, seine Arbeit bekannt zu machen; geschrieben Loewen 1555. 'Quorsum παραδοξότατος iste philosophus? quid cum Prutenicis tabulis aliud molitur, quam vt e manibus studiosorum ALPHONSI tabulis excussis, atque eis quidem tam dudum a maioribus nostris in vsum receptis et approbatis, totum orbem in nouam caliginem deducat, et tantorum virorum suffragio excluso totum ad se trahat?' FRISIUS dachte über Tafeln nach des COPERNICUS Weltordnung so, wie spätere Aerzte über Umlauf des Blutes und chemische Arzneyen dachten." A somewhat similar opinion is expressed by PROWE (*Nicolaus Coppernicus*, II, 392-3n), who finds that GEMMA did not accept "die Coppernicanische Lehre für mehr als eine Hypothese." Of a contrary belief is VAN ORTROY (*Bio-Bibliography de Gemma Frisius, Mémoires*, Académie Royale de Belgique, 1920, XI, 342), who states in passing, without discussion, "le médecin-géographe s'était résolument rallié au système planétaire" of COPERNICUS.

GEMMAE PHRYSII.

ab experientia recedat. Omitto intolerabiles in motu Mercurij errores. Taceo æquinoctij verni ſitus fallaciſſimos, aliaq; multa, quorum nos quotidiana obſeruatio adiuta per Geometricas demonſtrationes certiores facere poteſt. Hoc ſtudium fuit Copernici, viri ingenioſiſſimi & ſolertiſſimi, hoc nos pro noſtra tenuitate per multas obſeruationes, ex quibus hęc pulcherrima ſcientia initium progreſſumq; capit, adiunctis etiam demonſtrationum fulcimentis infallibilibus, ſequuti ſumus. Hoc demum ordine ſuam μεγαλὴν σύνταξιν exſtruxit diuino ſanè inuento Ptolemæus, Copernicus deinde ſuum opus Reuolutionũ abſoluit, ex quo Eraſmus Rhein holdus indefeſſo labore tabulas elaboratiſſimas Prutenicas collegit. De his igitur nemo cẽſuram ferre poterit, niſi qui eiſdem principijs vſus, hoc eſt, τῶν φαινομένων καὶ ἐκφάσεων, ſimili vt illi via proceſſerit. Verùm hoc opus, hic labor eſt, ſic patet iter ad aſtra. Taceant igitur, etſi placeat, conficiant ſua prognoſtica (vt vocant) ex malè locatis, tam fixis, quàm erraticis ſtellis. Auſpicentur annum 12. horis ante verum æquinoctium: garriant graculi: inepti ant, quantum velint & lubeat, interim permittant τοῖς ἀστρολόγοις φιλοσοφοῦντας ſuis frui cõmodis, vel ſi placeat ἀστρόνας & candidè impartitis vnà cum illis fruantur. Ac tantum de diuerſitate tabularum & de authorum authoritate. Reſtat iam vltimus nodus de terræ motu, Soliſq; in mundi centro quieſcentis τὸ παράδοξον. Verùm quum & philoſophia, & demonſtrationis methodo carent, non intelligunt hypotheſium cauſas & vſum. Non enim illa ſtatuuntur ab authoribus, tanquàm neceſſariò ita ſe habere debeant, neque aliter conſtitui poſſent. Sed vt aſſumptis nõ prorſus abſurdis, ſed naturæ congruis exordijs, habeamus certam rationem motuum correſpondentem, in cœlo conſpicuis ſtellarum locis, tam pro tempore futuro vel elapſo, quàm pro præſenti. Quamuis verò hypotheſes Ptolemæi prima facie ſint plauſibiliores, quàm Copernici, non pauca tamen iſſæ abſurda committunt, dum ſtellæ in ſuis circulis inæqualiter moueri intelligũtur, tum non habent tam euidentes τῶν φαινομένων cauſas, atq; illæ Copernici. Nam quòd tres ſuperiores planetæ (vt demus exemplum) ἀνωμάλως, ſiue è diametro Solis poſiti, ſemper ſint in perigeo ſui epicycli, aſſumit Ptolemæus, atque hoc eſt τὸ ὅλον. Verùm Copernici hypotheſes idem illud neceſſariò inſerunt, ac demonſtrant διὸλα. Neq; quicquam ferè abſurdum naturalibus motibus committunt, vnde hic amplior cognitio de planetarum diſtantijs colligitur, quàm ex illis. Quin ſi quoque quiſpiam velit, poterit illos motus terræ, quos præter duos primos ponit, ad cœlum referre, ac vti ijſdem Canonibus calculorum. Sed non placuit

b 3 viro

EPISTOLA GEMMAE PHRYSII.

viro doctiſſimo & prudentiſſimo, ob ingenia hęc indomita, totam Hypotheſium ſuarum ordinem inuertere, contentus ſtatuiſſe, quę ad veram τῶν φαινομένων inuentionem ſufficerent. Habebam multa, quæ hic adijcerem, niſi deſiderium animi mei me ſtimularet ac vrgeret, vt te mox ad æditionem tuarum Ephemeridum protruderem, cogeremq́ue. Vides me omnes ſcrupulos, qui moleſtiam in progreſſu facerent, quantum in me eſt, exemiſſe. Perge bonis auibus, abſolue ſtadium propoſitum, amiciſſime Stadi: crede mihi (ſi quid ego rectè iudico) accipies βραβεῖον nominis æternitatem. Vale. Louanij, pridie Calendas Martias, Anno 1555.

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FIG. 1. — Pages b3 recto and verso of the *Epistola* of GEMMA FRISIUS. IOANNES STADIUS, *Ephemerides Novae*, Cologne, 1560. Library of Congress copy. Length of line in the original, 112 mm.

It also gives a better knowledge of the distances of the planets than does the theory of PTOLEMY. GEMMA FRISIUS then concludes the astronomical comment of his epistle with a hint of the opposition COPERNICUS had faced, and a further word of praise for this learned man who would not change his hypothesis because of antagonistic minds, but instead established the things sufficient for true finding and interpretation of phenomena.

To those who are familiar with the *Castle of Knowledge*, this discussion is much more to the point than the incomplete and vacillating account provided there by ROBERT RECORDE (6). It is as favorable to COPERNICUS as are the epistles of FIELD and DEE, who as scientists were certainly of no greater reputation than this well-known physician and mathematician. His discussion, in addition, appears to be the earliest of the four. The *Epistola* of GEMMA FRISIUS should have a place in the history of the rise of the Copernican theory.

Smith College GRANT MCCOLLEY.

(6) DREYER and others who follow DE MORGAN have, I believe, made too much of RECORDE's unfulfilled promise to provide at another time the reasons supporting the motion of the earth. This statement (ed. cit., p. 165) must be evaluated and interpreted in connection with the preceding one to which it refers in the words, " but an other time, as I saide." What RECORDE actually proposes to do (*ibid.*, p. 164), is to give the arguments both for and against the belief : " but the reasons are to difficulte for this firste Introduction, and therefore I wil omit them till an other time. And so will I doo the reasons that PTOLEMY, THEON and others doo alleage to proove the earthe to bee without motion." These are not the words and this is not the attitude of GEMMA, whose advocacy is clear cut and unreserved.

Ioannes Nardius (ca. 1580—ca. 1655)

1. *Date of Nardi's birth.*—GIOVANNI NARDI, "Aesculapius Florentinus," has been overlooked by the *Biograph. Lexikon der hervorragenden Ärzte* and by the mangificent new *Enciclopedia Italiana*. NARDI was born in Montepulciano. The biographical sketch in FERGUSON's *Bibliotheca Chemica* (1) does not state when NARDI was born and when he died. In the fourth dedicatory epistle in NARDI's edition (2) of LUCRETIUS, written not later than 1644, the year of BALDO BALDI's (3) death, NARDI states (4) that he is a sexagenarian; he was, therefore, born before 1584.

2. *Date of Nardi's death.*—NARDI's *Noctes geniales* appeared posthumously, in 1656. The editor, ELIAS SCHOTTELIUS Hala-Tyrolensis, Philosoph. Magister, ac Medicinae Candid., informs the gentle reader that NARDI died while the book was in the hands of the printer: "... ipse adhuc Viuus typis commisit, at acerba Morte praeuentus perficere nequijt." The manuscript of the *Noctes geniales* was submitted to the censors in February, 1652, the imprimatur was given in October, 1653. It is,

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(1) JOHN FERGUSON, *Bibliotheca Chemica*, vol. 2, p. 126, Glasgow, 1906.

(2) TITI LUCRETII CARI *De rerum natura* libri sex. Vnà cum Paraphrastica Explanatione, & Animaduersionibus, D. IOANNIS NARDII Florentini. Florence, 1647. The dedication of Book VI to BALDI occupies the pp. 435 and 436; Book VI of *De rerum natura* begins on p. 437. BALDI died while the manuscript was in the hands of the censors (submitted, February, 1644; imprimatur, May, 1645).

(3) BALDO BALDI, archiater of URBAN VIII (d. July 29, 1644) and of INNOCENT X (succeeded URBAN VIII, Sept. 15, 1644), died in 1644. Among BALDI's writings were *De contagione pestifera* praelectio, Rome, 1631, and *Opobalsami orientalis...*, Rome, 1640.

(4) "Par erat, Optime BALDE, Optimi, Maximique Principis Archiater meritissime, vt nostri ocij seram Tibi redderem rationem, non tamen absque vsura. Multa me sexagennarium circumueniunt incommoda, effoetae vires, dubia valetudo, domesticae curae, liberorum educatio: prestò sunt nec non iurgia fori, impiaeque harpagonum manus. Quod superest ocij, laboriosissimo, omniumque miserrimo debetur negocio, quaerelis, nempe, iacentium atque obtrectantium."

therefore, reasonable to assume that NARDI died about 1655. The posthumous edition of the *Noctes geniales* is dedicated, by PHILIPPUS NARDIUS Auct. fil., to Cardinal CARLO DE' MEDICI (5), but the letter of dedication contains no information concerning the date and place of the death of PHILIPP's father. It is probable that GIOVANNI NARDI died in Florence.

3. *Medical studies in Pisa.*—In the first dedicatory epistle of *De rerum natura*, addressed to IOANNES ANDREAS RICCIUS, NARDI refers (6) to the six years which he spent in the Ricci College, in Pisa. It ought to be possible to determine the year in which NARDI received his medical degree.

4. *The plague in Florence*, 1630.—" Contagij remedium vnicum esse dissociationem " (7) was NARDI's credo. The pages 593 to 598 of NARDI's edition of *De rerum natura* offer, in the Animadversio XLVII : De Peste Florentina inuadente A.S. 1630, an important and fascinating autobiographical chapter which is hereby called to the attention of the future biographer of NARDI.

5. *Nardi's edition of Lucretius.*—This quarto volume of XII+ 680 pages is more valuable to historians of science than to philologists. Its Egyptological importance is dealt with elsewhere (*Isis*, 26, 150, 1936); its autobiographical importance has been pointed out in the preceding paragraphs. The volume contains fifty animadversiones; exactly half of them belong to Book VI; sixteen of these, Animadv. XXXIII to Animadv. XLVIII, deal with the plague; the dedication of Book VI to BALDO BALDI was, therefore, quite appropriate. The remaining animadversiones cover a wide range of subjects; one quotation will suffice: Animadversio IV. Exercitatio cum DANIELE SENNERTO de Atomis (8).

6. *Noctes geniales.*—FERGUSON's *Bibliotheca Chemica* quotes the title of this book as follows : " Noctium Genialium physicarum, Annus primus, Bonon., 1655, 4°." For the sake of record, I

(5) CARLO DE' MEDICI (1596-1666), the uncle of Cardinal GIOVANNI CARLO DE' MEDICI (1611-1663).

(6) " ... Nam siquid profeci profecturusue sum in posterùm, id omne Ricciae Prosapiae tribuo, cuius sub vmbraculo vixi per sexennium Pisis Gentilio in Collegio, quod Eminentiss. IOANNES RICCIUS S.R.E. Card. & Archiepiscopus Pisanus, consulens ingenuis Politianis Conciuibus erexit olim, atque dotauit."

(7) *De rerum natura*, Animadversio XLVII, p. 597.

(8) DANIEL SENNERT (1572-1637) was, by the way, a victim of the plague.

reproduce here the title of the copy in the Library of the Surgeon General's Office: NOCTES / GENIALES / AVCTORE / D. IOANNE NARDIO / FLORENTINO / ANNVS PRIMVS. BONONIAE M.DC.LVI. / Typis Io. Baptistae Ferronij. Superiorum permissu. The quarto volume contains XII+748+XL pages. To the historian of XVIIth-century science, the *Noctes geniales* are just as valuable as NARDI's edition of *De rerum natura*. The book covers a wide range of subjects, and reveals the author at his best—and at his worst. Thus, on p. 301, NARDI, the experimental scientist, points out (9) that leaden vessels are unsuitable for chemical operations; on p. 276, NARDI, the layman, attacks (10) the heliocentric system.

7. *Pseudo-Nardiana.*—FERGUSON's *Bibliotheca Chemica* lists, in addition to "De rore, disquisitio physica, Flor., 1642, 4°," a title, "De voce, disquisitio physica, Flor., 1642." The second title is, apparently, spurious; it is not listed in the XVIIIth-century bibliographies accessible to me; the error seems to be due to a careless transcription of the word "rore." Another pseudo-Nardianum is listed in the *Catalogue général* (11) of the Bibliothèque nationale: *De Unguento armario*, in the *Theatrum sympatheticum auctum*, Nuremberg, 1662. *De Unguento armario* was written by JOH. FREITAG (12), and it begins on p. 609 of the *Theatrum;* it is preceded by NARDI's opusculum, *De Prodigiosis Vulnerum Curationibus*, which begins on p. 605 and is not listed in the *Catalogue général*. For the sake of completeness, it might be added that the *Theatrum* contains also an excerpt from KIRCHER's writings, *Sententia de Unguento Armario ex libro III. ejusdem de Arte Magnetica desumpta*, and that NARDI, KIRCHER, and FREITAG are not represented in the previous editions of the *Theatrum sympatheticum*, Nuremberg, 1660, and Amsterdam, 1661.

8. *Nardi's principal writings.*—We have mentioned NARDI's

(9) "... Vbi enim per plumbea vasa destillatae sunt aquae, lactescunt confestim, atque turbantur, quod experimentum repetam, si vobis placet, Collegae, cogamque liquorem deponere furtum... Valuit tandem euidentia, paradoxon suadere reluctantibus."

(10) "... Solem stare, circumuolui terram Pythagoricum delirium fuit, cui labanti manus dedere COPERNICUS, & Recentiores alij, malo cum suo."

(11) Tome 122, col. 934, Paris, 1933.

(12) JOHANN FREITAG (1581-1641).

edition of *De rerum natura*, and his *Noctes geniales*, *De rore*, and *De prodigiosis vulnerum curationibus*. Msgr. GIOVANNI MERCATI (12a), in his letter quoted in *Isis*, 26, 150, 1936, calls attention to NARDI's *De igne subterraneo*, Florence, 1641, which is mentioned in GALILEO's correspondence. NARDI's earlier publications include *Lactis physica analysis*, Florence, 1634, and *Apologeticon in Fortunii Liceti mulctram, vel de duplici calore*, Florence, 1638 (13). All these titles are listed in FERGUSON's *Bibliotheca Chemica*, and copies of all these works are both in the British Museum and in the Bibliothèque nationale.

9. *Additional Nardiana.*—Here is a necessarily incomplete list of items not listed in FERGUSON's *Bibliotheca Chemica*. First, the polemical writings mentioned by JÖCHER (14): NARDI "wechselte auch mit FORTUNIO LICETO Streitschriften"; since JÖCHER lists the *Apologeticon* among NARDI's published works, these Streitschriften seem to form a distinct, apparently unpublished group of Nardiana. Second, an epistola de opobalsamo, "PAULO ZACCHIAE, & BALDO BALDIO, Medicis Romanis Praeclarissimis, IOANNES NARDIUS Philosophus Medicus Florentinus" (15), published on pp. 66-68 of BALDO BALDI's *Opobalsami orientalis...*, Rome, 1640; it was reprinted, on pp. 219-224, in VOLCKAMER's (16) *Opobalsami orientalis... examen*, Nuremberg, 1644; an Italian translation of the epistle, made by F. PANUZZI (PANUTIUS), is listed in the *Catalogue* of the British Museum, among NARDI's writings. Third, NARDI's *De China China Tractatus*, mentioned by SÉGUIER (17).

Library of Congress, Washington, D.C. ALEXANDER POGO.
May, 1936.

(12a) Created Cardinal, June, 1936.

(13) FORTUNIO LICETI (1577-1657).

(14) CHRISTIAN GOTTLIEB JÖCHER (1694-1758), *Allgemeines Gelehrten-Lexicon*, vol. 3, col. 816, Leipzig, 1751.

(15) PAOLO ZACCHIA (1584-1659).

(16) JOHANNES GEORGIUS VOLCKAMER (1616-1693).

(17) JEAN FRANÇOIS SÉGUIER (1703-1784), *Bibliotheca botanica*, p. 284, The Hague, 1740.

Kunitomo and his astronomical activities in the pre-Meizi era.

Up to very recent time KUNITOMO-NOOTOO (popularly called " KUNITOMO-TOOBEI ") was known merely as an artisan skillful in gunsmith work for the Shogunate. In 1931 I just happened to examine some of his relics kept in the house of his descendants, and found that he was an excellent astronomer of originality and skillfulness. KUNITOMO was born in 1778 in Omi, Japan, and in his 17th year he succeeded his father as a gunsmith. His invention of a new type of air-gun in 1819 is well known in the history of Japanese technology.

According to his own statement, KUNIMOTO had a chance of inspecting a telescope, imported from Holland, at the house of NARUSE-HAITO-NO-SYO, a nobleman at Yedo, about 1821-1822. This must have impressed him exceedingly, although his time was probably limited as judged by the circumstances, so that ten years later, i.e., in 1832 (in his 55th year) he planned and began to make one for himself. In the beginning of the work he met many difficulties in designing parts and selecting mirror-materials. But by the end of the next year he quite successfully completed a Gregorian reflector of 7 cm. aperture. And immediately he began to observe the moon's surface and Jupiter's satellites. For the first few months he was training himself in making accurate sketches of these and other planetary bodies. Soon he became acquainted with the usual phenomena, and his accuracy gained considerably. He was especially skillful in observing the ever changing planetary configurations, and was very proficient in precisely sketching the phenomena, so that an error of 3" or 4" in the positions of satellites was intolerable. During his later years his sketches of the moon's surface did not show, however, much improvement in details which were perhaps too complicated for him.

One of the most distinguished contributions from KUNITOMO's astronomical observations is the remarkable series of sunspot sketches extending over 15 months. He began his systematic observations of sunspots on February 3, 1835. His usual program was to observe the solar surface twice every day, in the morning

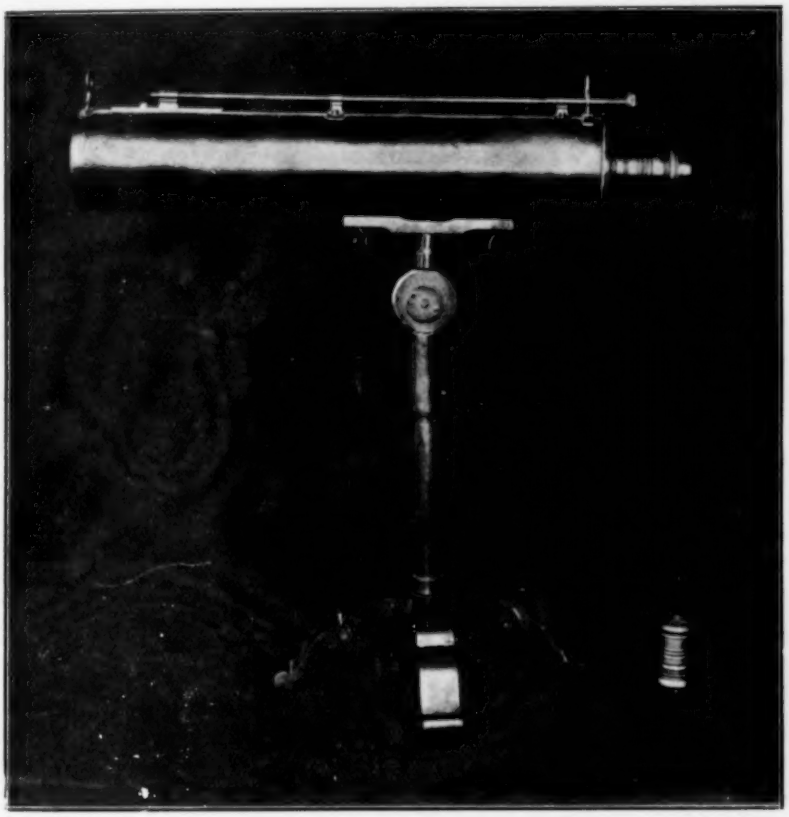


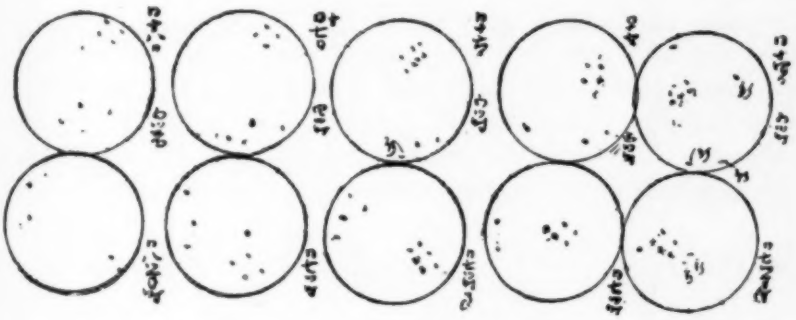
Fig. 1. — 7 cm. Gregorian reflecting telescope made by N. KUNITOMO in 1832.

and in the afternoon. His morning observations were as a rule at about 8 o'clock, while his afternoon observations were made usually at about 4 o'clock. But of course this daily program was frequently influenced by weather conditions so that his earliest morning observations on record were made at 6 a.m., while his latest afternoon observations were made at 6 p.m. Accordingly

he must have been persistently watching the clear sky for practically the whole day when the weather was variable. His notes of the sunspot observations come to an end abruptly on March 24, 1836. The reason for this sudden break of records is not evident. It ought to be remembered in this connection that the year 1836 was the epoch when the whole country of Japan severely suffered from a great rice-famine; KUNITOMO himself was reported to have raised funds, in order to help his neighbors, by selling his spare telescopes to noble or wealthy men. Accordingly the reason of the break in his sunspot notebook might be due to the loss of records or to a real suspension of daily work.

Now, the total number of the days of observation of sunspots made by KUNITOMO is 158, during which 143 morning and 72 afternoon observations were recorded, so that there are 215 sketches during the interval. The features of his sketches are exactness in heliographic positions and precision in sketching details of sunspots. An error of a millimeter in position was quite intolerable on a solar disc of 5 cm. After several months of careful observation he " discovered " the distinction between umbrae and penumbrae, in September, 1835. On the other hand, his afternoon observations were entirely uninfluenced by his morning observations of the same date, so that he sketched everything exactly as he saw it at that time. Winds, haze, etc. disturbed sometimes his solar images through the telescope; yet he sketched what he was actually seeing, and nothing else. He was naturally-sensitive observing the telescopic details of the solar limb. In this way he seems to have had a spirit of a genuine scientist in the modern sense. It was fortunate that the sunspots were very active on those days of observations, and sometimes he saw, with his small telescope, five or more spot-groups at a time, so that he was constantly stimulated by the phenomena themselves. I have published KUNITOMO's sunspot observations in the *Bulletin* No. 303 of the Kwasan Observatory, Kyoto, 1935; the dates are given in two styles : in the Japanese lunar calendar and in the Gregorian calendar. We can get the " relative numbers " of sunspots in those days from KUNITOMO's observations. As I understand, the solar observations were not very systematically and accurately made in other countries a century ago; the present results would be very serviceable for the students of solar activity.

KUNITOMO died early in 1841 in his 63rd year. His last four years were not productive, apparently, from the astronomical point of view. In the autumn of 1836, there are found some fragmentary observations of the sun, the moon and the three brightest planets; it is highly probable that the widespread famine at that time caused practical suspension of his mechanical as well as astronomical work. By that time, however, he had, according to his own notes and also to his correspondence with others, completed many sets of telescopes at his workshop, most of them being distributed among his friends and noble patrons.

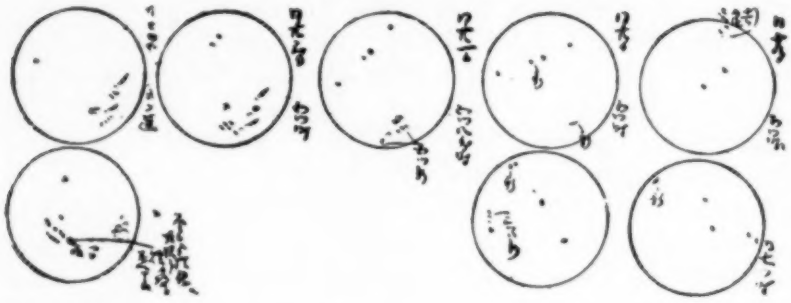


Sept. 10.	Sept. 9.	Sept. 8.	Sept. 7.	Sept. 6, 1835
8 A.M.	10 A.M.	8 A.M.	8 A.M.	8 A.M.
3 P.M.	4 P.M.	4 P.M.	4 P.M.	5 P.M.

Fig. 2. — KUNITOMO's sketches of Sun-spots.

One of his latest telescopes was brought to Osaka and purchased by HAZAMA, an official astronomer, who compared this telescope with the one in his possession which had been obtained from Holland, and reported that the former was " twice as efficient " as the latter; we thus can see how good the telescope of KUNITOMO must have been. Today there is kept in the house of his descendant a complete set of his Gregorian telescope, and a number of minor parts. Mr. K. NAKAMURA of Kwasan Observatory made a close examinations of the figures of the two parabolic mirrors (the one used in the complete set, and the other among the spare parts). The excellency of these mirrors, especially the former one, is well proved.

It is remarkable that KUNITOMO had such rare abilities not only as an excellent craftsman but also as an observer of precision. It is true indeed that he had had the fundamental experience, inherited from his forefathers, in making mechanical instruments and also metallic (plane) mirrors during the years before he began to turn toward astronomy. But he seems not to have had any personal friends connected with the exact sciences of those days, nor to have read any of the ordinary books on astronomy already current at that time among the official and private scholars. Lack of these external contacts with scholastic circles is well proved by the fact that he made, during his years of activity, quite a



Sept. 16.	Sept. 15.	Sept. 13.	Sept. 12.	Sept. 11, 1835.
8 A.M.	8 A.M.	9^h40^m A.M.	8 A.M.	8 A.M.
(?)			(?)	4 P.M.

Fig. 3. — KUNITOMO's sketches of Sun-spots.

number of important discoveries of heavenly phenomena, among which those of sunspot penumbrae, details of the lunar surface, etc., which had really been fairly well known to contemporary astronomers who could read some of the Dutch books in current use; the announcement of his discovery of the fifth satellite of Jupiter, made on December 8, 1835, was another proof of his ignorance of the current knowledge of astronomy.

In this way, KUNITOMO was a genuine amateur astronomer of originality, accuracy and zeal. It is regrettable, indeed, that he began his astronomical career at an advanced age. If he had started much earlier, his contributions to the science might have been more extensive. A few learned friends might have contributed to the efficiency of his original researches.

His lack of acquaintance with advanced mathematics did not affect the figuring of his parabolic mirrors. But his fatal ignorance of modern optics made him suffer from troubles caused by chromatic aberration of eye-pieces.

Modern astronomy was introduced in Japan after the opening of the Meizi era, i.e., practically, after 1870. It is true that some scientific European books had been imported, mostly from Holland, during the 18th century. A few official astronomers could read LALANDE's and KEIL's books in the very beginning of the 19th century. But these astronomers were naturally classical in their line of study; in other words, they were engaged in the study of the positions and the motions of stars, and were not interested in astrophysical matters, nor were they quite free from traditional ideas of past years. KUNITOMO was entirely liberal and original in every way of study. Despite his advanced age, he went wherever he was led by his interests developed by his own telescopes. He was the forerunner of the liberal astrophysicists in Japan.

Kyoto, Kwasan Observatory. ISSEI YAMAMOTO.

Darwin's conception of the theory of natural selection

(After an unpublished letter of 1861)

With the kind permission of the Trustees of the British Museum I am able to publish below in extenso, the text of a letter by CHARLES DARWIN which has not yet been published. At any rate it is not included in any of the collections where one might expect to find it, to wit

FRANCIS DARWIN : *The life and letters of* CHARLES DARWIN, *edited by his son* (3 vols., London, 1887).

FRANCIS DARWIN and A. C. SEWARD : *More letters of* CHARLES DARWIN (2 vols., London, 1903).

HENRIETTA LITCHFIELD : EMMA DARWIN (1), *a century of family letters*, 1792-1896, *edited by her daughter* (2 vols., London, 1915).

The letter was presented to the British Museum in 1908 by the widow of THOMAS THORNTON, Esq. It covers eight small pages (18 1/2 × 12 cm.) in DARWIN's own hand and bears the registration number Add. MS. 37725, f. 6. I reproduce below with the Trustees' permission the most significant page (p. 3). An extract from the letter was quoted in the *Guide to the exhibited MSS. Part I* (p. 73, British Museum, 1912).

The letter is dated March 14th but without mention of the year. That year was certainly 1861 for the following reasons. DARWIN refers to " a new and corrected Ed. of the *Origin* which will appear in about a week or two."

Now the first edition of the *Origin of Species* was published on Nov. 24, 1859, all copies (1250 in number) being sold on the first day. A new edition of 3000 copies was issued on Jan. 7, 1860 : this cannot be the one referred to, which appeared a

(1) That is, EMMA WEDGWOOD (1808-96), who was married to CHARLES DARWIN (1809-82) in 1839.

short time after the middle of March. The reference fits very well to the third edition (2000 copies) published in April 1861.

In the second place, DARWIN refers as to a recent publication to AGASSIZ's review of the *Origin* which had appeared in SILLIMAN's Journal on July 1860.

DARWIN's correspondent is unknown. He was probably an American botanist,—but not ASA GRAY, an old friend whom DARWIN addressed " My dear GRAY ". It would be interesting to determine his identity.

However the main value of this letter lies in DARWIN's appreciation of the theory of natural selection. The comparison with the wave theory of light is a very apt one, which I have not found elsewhere in his writings except in a letter which he wrote at about the same time (April 20, 1861) to FREDERICK WOLLASTON HUTTON (1836-1905), a geologist who emigrated to New Zealand a few years later (1866) and was there professor of geology and curator of the Canterbury Museum in Christchurch, N.Z. DARWIN wrote to him

" I am actually weary of telling people that I do not pretend to adduce direct evidence of one species changing into another, but that I believe that this view in the main is correct, because so many phenomena can be thus grouped together and explained. But it is generally of no use; I cannot make persons see this. I generally throw in their teeth the universally admitted theory of the undulation of light,—neither the undulation nor the very existence of ether being proved, yet admitted because the view explains so much." (2)

This illustrates DARWIN's moderation and caution. As he wrote on June 6, 1863, to another young naturalist, the self-taught botanist JOHN SCOTT (1838-80) :

" I would suggest to you the advantage, at present, of being very sparing in introducing theory in your papers (I formerly erred much in Geology in that way) : *let theory guide your observations*, but till your reputation is well established be sparing in publishing theory. It makes persons doubt your observations." (3)

The reader will excuse me for taking this opportunity of referring him to an earlier Darwinian paper " The discovery of the theory of natural selection " (*Isis* 14, 133-154, 1930), which contains facsimile reprints of the earliest publications of DARWIN and ALFRED RUSSEL WALLACE (1823-1913) on the subject.

(2) *More letters* (vol. 1, 184).
(3) *More letters* (vol. 2, 323; see also vol. 1, 217-8).

After his return from the " Beagle " voyage (1831-36), DARWIN lived for a few years in London and Cambridge; then on Sept. 14, 1842 he moved to Down where he spent the rest of his life,—forty years of quiet and almost uninterrupted work and meditation. Down House in Downe, Farnborough, Kent, is now a national museum open to the public, and the official residence of the secretary of the B.A.A.S. I made a pilgrimage to it on September 19, 1934 in the company of F. S. MARVIN and was deeply impressed. I would advise every historian of science who happens to be in London to drive to Down : this can be conveniently done within an afternoon. For more information see the descriptive pamphlet (*Isis* 16, 508; 23, 533 f.) or HOWARTH : *A history of* DARWIN's *parish* (Southampton, 1933; *Isis* 23, 534).

The letter reproduced below is dated " Down "—that is Down House, in Downe. Sir GEORGE BUKSTON BROWNE, who gave DARWIN's house to the B.A.A.S. never tires of pointing out the difference between Down (the house) and Downe (the village). This matters but little, but go to Downe and Down if you can !

GEORGE SARTON.

March 14th [1861] Down, Bruly (?) (4), Kent

Dear Sir

I am much obliged for your long letter, as I always like to know how naturalists view the subject. I feel not a shade of surprise at your entirely rejecting my views : my surprise is that I have been successful in converting some few eminent Botanists, Zoologists and Geologists. In several cases the conversion has been very slow and that is the only sort of conversion which I respect (5). I *entirely*

(4) This word Bruly (?) is badly scribbled; should it read Bromley?

(5) DARWIN was perhaps thinking here of J.D.HOOKER and of CHARLES LYELL to whom he wrote on Nov. 23, 1859 : " To have maintained in the position of a master, one side of a question for thirty years, and then deliberately give it up, is a fact to which I much doubt whether the records of science offer a parallel. For myself, also, I rejoice profoundly; for, thinking of so many cases of men pursuing an illusion for years, often and often a cold shudder has run through me, and I have asked myself whether I may not have devoted my life to a phantasy. Now I look at it as morally impossible that investigators of truth, like you and HOOKER, can be wholly wrong, and therefore I rest in peace." (*The life and letters of* CHARLES DARWIN, vol. 2, 229, 1887). On March 3, 1860, DARWIN enclosed in a letter to HOOKER a memorandum of the scientists who had already accepted his views. I quote it from the same book p. 293 :

illustrate & to case of Light. —
The ether — hypothetical, &c. as
its undulations; but as the
undulatory hypothesis groups
together & explains a multitude
of phenomena, it. is universally
admitted in the true theory.
The undulations in the ether
are considered in some degree
probable, because sound is
produced by undulations in air.
So natural selection, I look
at as in some degree
probable, or possible, because
we know what artificial
selection can do. — But I
believe in Nat. Selection, not

agree with you that there is no more [p. 2] direct proof of variation being *un*limited in amount than there is that it is strictly limited. In a new and corrected Edit. of the Origin, which will appear in about a week or two, I have printed this as emphatically as I could. I did not formerly explicitly say this (but indirectly in several places) because I thought it was obvious. The manner in which I wish to approach the whole subject, and in which it seems to me it may fairly be approached, I can best [p. 3] illustrate in the case of Light. The ether is hypothetical, as are its undulations; but as the undulatory hypothesis groups together and explains a multitude of phenomena, it is universally now admitted as the true theory . The undulations in the ether are considered in some degree probable, because sound is produced by undulations in air. So natural selection, I look at as in some degree probable, or possible, because we know what artificial selection can do. But I believe in nat. selection, not [p. 4] because, I can prove in any single case that it has changed one species into another, but because it groups and explains well (as it seems to me) a host of facts in classification, embryology, morphology, rudimentary organs, geological succession and Distribution. I have no space to discuss the many points alluded to in your letter. I cannot see such perfection in structure as you do. In the new Edit. I have attempted to explain how it is that [p. 5] many low forms have not progressed to a higher grade of organisation. I did not allude to the very curious subject of " alternate generations " because I did not, and do not yet, see, how it has any *special* bearing on my views. I look at alternate generations, as not essentially differring from various stages in any one individual larva—a form of generation being merily added at some stage. [p. 6] Under the point of view I see no essential difference between alternate generations and metempsychosis : you, I presume, take some very different view. I forget what AGASSIZ says on the subject. I quite agree with you that AGASSIZ' Review (6) is not in the least unfair. He misunderstands me a good deal. His [p. 7] " categories of thought," " prophetic types " and his views on classification are to me merely empty sounds. To others they seem full of meaning.

I received several months ago and thank you for, a very curious pamphlet on representative form (7) (or some such title) which interested me *very much*. With [p. 8] the best thanks, I remain,

Dear Sir
Yours very faithfully
CHARLES DARWIN.

I am much pleased at and grateful for a sentence which you kindly copy from a recent letter from AGASSIZ. I once saw him, and was charmed with him.

Four geologists : LYELL, ANDREW RAMSAY, J. B. JUKES, H. D. ROGERS. Four zoologists and palaeontologists : HUXLEY, J. LUBBOCK, L. JENYNS (to large extent), SEARLES WOOD. Two physiologists : CARPENTER, Sir H. HOLLAND (to large extent). Five botanists : HOOKER, H. C. WATSON, ASA GRAY (to some extent), Dr. BOOTT (to large extent), THWAITES. In all fifteen men, not a very large number.

(6) This refers almost certainly to LOUIS AGASSIZ' review of the *Origin of Species* in the *American Journal of Science and Arts of July* 1860. See *Life and Letters* (vol. 2, 330, and by index).

(7) I cannot be quite sure of the reading of these two words because I do not understand the reference.

Malthus, Darwin, and Bagehot: A study in the transference of a concept*

ABSTRACT: A familiar phenomenon in the history of science is the transference of a concept from one field of investigation to another. At present the newer concepts in use in physics are being applied in the social sciences. The classic example of this transference phenomenon is the concept of evolution; originating in the social sciences, it was taken over into biology and thence to the whole range of current thought. This paper aims at tracing the use of one idea—the struggle for existence—by MALTHUS *in 1798 in an attempt to solve a problem in economics and politics, its elaboration by* DARWIN *sixty years later into the theory of natural selection for the purpose of solving a problem in biology, and the immediate application of the combined doctrines by* WALTER BAGEHOT *in an effort to solve the problem of social change.*

A familiar phenomenon in the history of science is the transference of a concept from one field of investigation to another. The years of the present century, for example, have seen the use of concepts originally developed in physics applied to history and the other social sciences more or less generally (1). The classic example within the last hundred years is the concept of evolution. What is not generally recognized is the fact that the idea of evolution originated in the social sciences, even though DARWIN crystallized it in the field of biology, whence it has been taken over into the whole range of current thought. This paper proposes to trace the fundamental assumption of DARWIN's theory—namely, natural selection—from the source where he found it, THOMAS MALTHUS's famed *Essay on Population*, through its use by his own contemporary, WALTER BAGEHOT.

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* Adapted slightly from a paper read by abstract at a joint session of Section L of the American Association for the Advancement of Science and the History of Science Society in Berkeley, 22 June 1934.

(1) See JACQUES RUEFF: *From the physical to the social sciences ... translated by* HERMAN GREEN (Baltimore, etc.; 1929); CHARLES WOOLSEY COLE: "The relativity of history" (*Political Science Quarterly*, vol. 48, no. 2 (June 1933), p. 161-171); and [RALPH TYLER FLEWELLING]: "A quantum view of history" (*The Personalist*, vol. 15, no. 3 (July 1934), p. [199]-208).

The debt of DARWIN to MALTHUS is of course well known. He himself acknowledged it frankly in the first edition of the *Origin of Species* :

> ... the Struggle for Existence amongst all organic beings throughout the world, which inevitably follows from their high geometrical powers of increase, will be treated of. This is the doctrine of MALTHUS, applied to the whole animal and vegetable kingdoms. As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be *naturally selected* (2).

The circumstances under which DARWIN chanced upon MALTHUS are briefly recorded in the autobiographical recollections which he wrote for his children :

> After my return to England [in 1836 from the voyage of the " Beagle "] it appeared to me that by following the example of LYELL in Geology, and by collecting all facts which bore in any way on the variation of animals and plants under domestication and nature, some light might perhaps be thrown on the whole subject. My first note-book was opened in July 1837 ... In October 1838, that is, fifteen months after I had begun my systematic inquiry, I happened to read for amusement " MALTHUS on Population," and being well prepared to appreciate the struggle for existence which everywhere goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favourable variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of a new species. Here then I had at last got a theory by which to work ... (3)

It is unnecessary more than to mention the remarkable double coincidence attending the use by DARWIN of the Malthusian concept of the struggle for existence : its employment by ALFRED RUSSEL WALLACE for the same purpose and his transmittal of his formulation of the theory to DARWIN, the meanwhile all unknowing that DARWIN had been working on the idea for many years but had delayed publication until he could provide what he considered indisputable proof. The circumstances are fully and

(2) London, 1859, p. 4-5.

(3) *The life and letters ... edited by* ... FRANCIS DARWIN (2 vol., New York, 1889), vol. 1, p. 67-68. The suggestion from MALTHUS was incorporated into the text of the two essays that preceded the *Origin* itself, written in 1842 and 1844 but never published before the *Origin* (see CHARLES DARWIN : *The foundations of the* Origin of Species; *two essays written in* 1842 *and* 1844 ... *edited by* ... FRANCIS DARWIN (Cambridge (Eng.), 1909), p. 7, 88, 90).

interestingly set forth by both men in easily available sources (4).

Just what passages in MALTHUS's essay attracted DARWIN is not known, nor what edition he read. The first appeared in 1798, and the second in 1803, considerably modified from the first; all later editions differ but little from the second (5). Although the *Essay on Population* has been called ' a book which no one reads and all abuse ' (6), yet the whole burden of it—that, whereas population tends to increase at a geometrical ratio, food increases at only an arithmetical ratio, thus producing a " struggle for existence "—was exactly what DARWIN needed to explain the " survival of the fittest". He took over the phrase, " struggle for existence", from MALTHUS (7) and made it the cornerstone of the theory of the origin of species by natural selection. Judging from the use of the analogy between what DARWIN called " artificial selection", as the agency through which man is able to produce changes in domestic breeds of animals and plants, and " natural selection " (a term he adopted from current use by breeders) (8), as the agency operating outside the sphere of man's control, he could not help being greatly interested in MALTHUS's observations on man's breeding of plants and animals and on the transmissibility of characteristics by heredity. This passage appears in the first edition of the *Essay* and is almost unchanged in the later editions (9). It may well have been a reference to this

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(4) *More letters of* CHARLES DARWIN (2 vol., New York, 1903), vol. 1, p. 118; JAMES MARCHANT : ALFRED RUSSEL WALLACE : *letters and reminiscences* (New York and London, [1916]), p. 91-92, 95; WALLACE's *My life* (2 vol., New York, 1905), vol. 1, p. 232, 239-240, 361-363.

(5) The 3d ed. was pub. in 1806, the 4th (a reprint of the 3d) in 1807, the 5th in 1817, the 6th (and last before MALTHUS's death) in 1826, a 7th in 1872, and a 9th in 1890.

(6) JAMES BONAR : MALTHUS and *his work* ([2d ed.], New York, 1924), p. 3.

(7) ROBERT H. MURRAY : *Studies in the English social and political thinkers of the nineteenth century* (2 vol., Cambridge (Eng.), 1929), vol. 1, p. 6; TALCOTT PARSONS : article on MALTHUS in *Encyclopaedia of the Social Sciences*, vol. 10 (New York, 1933), p. 68-69.

(8) In a letter to LYELL in 1859 DARWIN said, ' Why I like the term is that it is constantly used in all works on breeding ...' (see *The life and letters*, as cited, vol. 1, p. 472, 508).

(9) Reprint : *First essay on population*, 1798, *with notes by* JAMES BONAR (London, 1926), p. 167-171; 7th ed. (London, 1872), p. 268-270. MALTHUS makes use of the highly amusing account of Sir ISAAC BICKERSTAFF's artificially selected ancestry as recorded in ADDISON and STEELE's *Tatler* paper no. 75 (1 Oct. 1709).

passage which led DARWIN to examine MALTHUS in the first place, for he was diligent in searching out all he could find on plant and animal breeding.

It may be incidentally mentioned that HERBERT SPENCER very nearly approached DARWIN's concept of natural selection and by the same road. In his essay, " A theory of population deduced from the general law of animal fertility", published in the *Westminster Review* in 1852 (10), he said :

> From the beginning pressure of population has been the proximate cause of progress. All mankind in turn subject themselves more or less to the discipline described; they either may or may not advance under it, but, in the nature of things, only those who *do* advance under it eventually survive (11).

Here is the birth of the phrase, " survival of the fittest," plainly based on the essential idea of MALTHUS, and later adopted by DARWIN, with full acknowledgment to SPENCER (12), in the *Origin*. As a matter of fact, Sir CHARLES LYELL even denied to DARWIN and WALLACE credit for originality of the concept of the struggle for existence (13). Passing over consideration of the proper proportion of credit for the origin of the idea, however, we now turn attention to an almost immediate influence of the publication of the *Origin*, namely, that on WALTER BAGEHOT.

BAGEHOT lived from 1826 to 1877, and was thus a contemporary of, though considerably younger than, DARWIN. He came of a wealthy banking family, was educated in Bristol and London and was early trained for the law, but soon turned to business and to writing on literary, political, and economic subjects. He knew many of the leading men in the England of his day and kept informed on the intellectual and scientific movements of the time by wide reading.

BAGEHOT left behind at his death an essay on MALTHUS, published posthumously, in which he summed up, more in rhetoric than justice, the contributions of the celebrated writer on population, as follows :

> There is nothing in Mr. MALTHUS's life which is worth mentioning, or which

(10) Vol. 57, no. 112 (new ser., vol. 1, no. 2 (April 1852), p. 468-501.

(11) Quoted from the partial reprint in his *Principles of biology* (2 vol., New York and London, 1910), vol. 2, p. 536, 527-528.

(12) New impression of 6th ed. (London, 1900), p. 77.

(13) *Antiquity of man*, p. 456; quoted in BONAR, as cited, p. 46.

illustrated his doctrines. He was an estimable gentleman and clerical professor; "a mild pottering person," I think, CARLYLE would have called him. Neither his occupation nor his turn of mind particularly fitted him to write on money matters: he was not a man of business, nor had he, like PALEY and similar clergymen, a hard-headed liking for an innate insight into the theory of business. He was a sensible man educated in the midst of illusions; he felt a reaction against them, and devoted the vigor of his youth to disprove and dispel them; and he made many sensible and acute remarks on kindred topics. But he has been among the luckiest of authors, for he has connected his name with the foundation of a lasting science which he did not plan and would by no means have agreed in (14).

In his best known work, however, BAGEHOT probably little realized how perfectly he was serving as the cross-fertilizing agent for bringing back into the social sciences the concept which DARWIN had found there (in MALTHUS, that is) and then applied in one of the natural sciences. This will be made clear at once by simply reciting the full title of the book: *Physics and politics; or, Thoughts on the application of the principles of "natural selection" and "inheritance" to political society*. The main title is obviously an alliterative metonymy, "physics" standing for the physical sciences as a whole and "politics" for the social sciences (15). The book appeared in 1872, but the contents, except for the sixth and last chapter, had been published in five instalments in the *Fortnightly Review* beginning in 1867. His famous essay, "The English Constitution", which had headlined the first number of the *Fortnightly*, in 1865, and continued for a year and a half in that journal, had hinted at the idea of evolution as a concept applicable to man (16) as well as to the rest of the organic world.

It will be remembered that DARWIN had, in the *Origin*, purposefully omitted any but the slightest reference to the inclusion of man in the evolutionary process. He says in his autobiography:

As soon as I had become, in the year 1837 or 1838, convinced that species were mutable productions, I could not avoid the belief that man must come under the same law. Accordingly I collected notes on the subject for my own satisfaction, and not for a long time with any intention of publishing. Although in the "Origin of Species" the derivation of any particular species is never discussed, yet I thought it best, in order that no honourable man should accuse

(14) *Works* (5 vol., Hartford (Conn.), 1891), vol. 5, p. 400.

(15) See MAX LERNER's article on BAGEHOT in *Encyclopaedia of the Social Sciences*, vol. 2 (New York, 1931), p. 384-385.

(16) MURRAY, as cited, vol. 2, p. 247.

me of concealing my views, to add that by the work " light would be thrown on the origin of man and his history." It would have been useless and injurious to the success of the book to have paraded, without giving any evidence, my conviction with respect to his origin.

But when I found that many naturalists fully accepted the doctrine of the evolution of species, it seemed to me advisable to work up such notes as I possessed, and to publish a special treatise on the origin of man. I was the more glad to do so, as it gave me an opportunity of fully discussing sexual selection ... The " Descent of Man " took me three years to write... [and] was published in February, 1871 (17).

It was thus begun about 1868, and it is therefore quite possible that BAGEHOT's first essay in the " Physics and Politics " series, in 1867, may have served as an impetus to DARWIN to publish his own book, though the available sources do not elicit any specific information on the point. The interval between the third and fourth papers of BAGEHOT was well over two years (July 1869 to December 1871); in the meantime the *Descent* had come out, mentioning BAGEHOT's three papers with evident approval (18).

BAGEHOT was fearless in applying the doctrine to man's cultural evolution, with its attendant explanation of the process as the natural selection of fortuitous variations. He was not wholly original, really, in thus extending to man the evolutionary theory. SPENCER had expounded his theory of social evolution implicitly in his *Social Statics* (19), published in 1850, and explicitly in his *First Principles*, in 1862 (20). But BAGEHOT interested himself primarily in that phase of the problem which deals with the transition from one cultural stage to another, and his procedure in the investigation merits attention in passing.

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(17) *The life and letters*, as cited, vol. 1, p. 75-76, 75.

(18) BAGEHOT's papers are mentioned four times in the 1st ed. and once more in the 2d ed. (1874).

(19) SPENCER's paper in *The Leader* for 20 March 1852 on " The development hypothesis " he called ' a profession of faith ' in organic evolution. Mental as well as physical organization was submitted to the notion of evolution in *The principles of psychology* (1855). The outline of universal evolution was prepared in 1858, and the publication of the *Origin of species* was a great encouragement. (SPENCER's *Autobiography* (2 vol., New York, 1904), vol. 2, p. 9, 16-19, 57-58; JAMES P. LICHTENBERGER : *Development of social theory* (New York and London, 1923; " Century Social Science Series "), p. 309, 318).

(20) C. H. DRIVER : " WALTER BAGEHOT and the social psychologists " (*The social and political ideas of some representative thinkers of the Victorian age ... edited by [Fossey]*. J. C. HEARNSHAW (London, etc;. [1933]), chap. ix (p. 194-221)), p. 202.

As for the prehistoric stages he could, naturally, only speculate, but when he considered peoples and ages for which historical records exist he found himself, albeit unconsciously, at odds with the main contention of the doctrine of evolution, namely, that the transition from one stage to another is gradual, slow, and imperceptible. Only by abstracting selected facts from the available total could he produce the appearance of even, orderly, and gradual change. One quotation will make this clear :

> No nation admits of an abstract definition; all nations are beings of many qualities and many sides; no historical event exactly illustrates any one principle; every cause is intertwined and surrounded with a hundred others. The best history is but like the art of REMBRANDT; it casts a vivid light on certain selected causes, on those which were best and greatest; it leaves all the rest in shadow and unseen. To make a single nation illustrate a principle, you must exaggerate much and you must omit much. But, not forgetting this caution, did not Rome —the prevalent nation in the ancient world—gain her predominance by the principle on which I have dwelt? In the thick crust of her legality there was hidden a little seed of adaptiveness. ... And the moral of their whole history is the same : each Roman generation, so far as we know, differs a little—and in the best times often but a *very* little—from its predecessors. And therefore the history is so continuous as it goes, though its two ends are so unlike. ... the history of Rome changes as a good diorama changes; while you look, you hardly see it alter; each moment is hardly different from the last moment; yet at the close the metamorphosis is complete, and scarcely anything is as it began. Just so in the history of the great prevailing city : you begin with a town and you end with an empire, and this by unmarked stages. So shrouded, so shielded, in the coarse fibre of other qualities was the delicate principle of progress, that it never failed, and it was never broken.
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> ... Judaea changed in inward thought, just as Rome changed in exterior power. Each change was continuous, gradual, and good (21).

At the same time BAGEHOT set forth the undoubted historical occurrence of periods of cultural stability and lack of change, which he characterized by his famous colorful terms, " crust of legality " (as above), " cake of custom," " customary law," " law of status," " net of custom " (22). Consequently, when he came to discuss, in the last chapter, "verifiable progress politically considered", he had to admit, as did DARWIN in the *Origin* when faced with a similar dilemma (23), that the historical

(21) *Physics and politics* (New York, 1873), p. 61-63.

(22) *Physics and politics*, as cited, p. 27-29.

(23) ' Geology assuredly does not reveal any such finely-graduated organic chain; and this, perhaps, is the most obvious and serious objection which can be urged against the theory.'—*Origin of species*, 1900 ed. as cited, p. 413.

evidence does not permit the picture of slow, gradual, and continuous change :

> As a rule (and as has been insisted on before), a stationary state is by far the most frequent condition of man, as far as history describes that condition; the progressive state is only a rare and an occasional exception (24).

This explicit view of the factor of stability in culture, was a remarkable contribution to the solution of the problem of social change, which since the time of HESIOD has engaged the fascinated if bewildered attention of the human mind (25), albeit BAGEHOT was quite unconscious of his aid in this direction.

The experience of DARWIN and BAGEHOT in thus landing in a mirk of inconsistency when they essayed to transfer a concept from one field of investigation to another illuminates the importance and value of the history of ideas to research in the history of science. As an illustration, this paper has aimed at tracing briefly the use of one idea, the struggle for existence, first by the ' seminal mind ' (26) of MALTHUS in an attempt to solve a problem in economics and politics a century and a third ago, then its elaboration by DARWIN sixty years later into the theory of natural selection for the purpose of solving a problem in biology, and finally the application of the combined doctrines by BAGEHOT soon afterward in an effort to solve the problem of social change.

Berkeley, Calif. THOMAS COWLES.

(24) *Physics and politics*, as cited, p. 211.

(25) The concept of motion, which when applied to human affairs had the form of recurring cycles with most of the Greeks and Romans, that of a modified cycle with Saint AUGUSTINE, that of never-ending unilinear advancement with CONDORCET and COMTE, seems to lie back of most social thought today.

(26) The phrase is applied to BAGEHOT by MURRAY (as cited, p. 220), but seems more suitably given to MALTHUS, who has elsewhere been called ' Strewer of Seed which reached its Harvest in the Ideas of CHARLES DARWIN and FRANCIS GALTON ' (*Annals of Genetics*, vol. 1, pt. 1/2 (Oct. 1925), frontispiece).

The discovery of X-rays

With a facsimile reproduction (no. XVIII) of RÖNTGEN'S *first account of them published early in* 1896.

1. Electrical knowledge has steadily progressed together with our ability to create a vacuum and to increase its degree of exhaustion. The electrical revival of the eighteenth century (which was more like a beginning than a revival for the electrical knowledge available at the end of the seventeenth century amounted to very little) was largely due to the discussions relative to the barometric glow (flashes of light observed by JEAN PICARD in 1675 in the vacuum chamber above the mercury) (1) and to the availability of practical airpumps. OTTO VON GUERICKE had begun his investigations in 1641, if not before, and he realized the famous Magdeburg experiments in Ratisbon 1654, yet the diffusion of the new knowledge was rather slow. The first publication of GUERICKE's airpump was made by the Jesuit KASPAR SCHOTT (*Mechanica hydraulico-pneumatica*, Würzburg 1657). GUERICKE's own account, completed in 1663, was not published until 1672 (*Experimenta nova ut vocantur Magdeburgica de vacuo spatio...*, Amsterdam, 1672). In the meanwhile the airpump had been improved by ROBERT HOOKE and ROBERT BOYLE (1660) (2) and by GUERICKE himself (1663).

2. BOYLE applied the air pump to the solution of the electrical riddles. Witness a long footnote (p. 29) in his *Experiments and notes about the mechanical origine or production of electricity* (London, 1675)—which was the earliest treatise on electricity in the English language. These experiments were continued with remarkable ingenuity by FRANCIS HAUKSBEE who published his results in

(1) Expérience faite à l'Observatoire sur le baromètre simple touchant un nouveau phénomène que M. PICARD y a découvert (1675, p. 112; *Mémoires de l'Académie royale des sciences*, tome X, 566, Paris, 1730). Only 17 lines.

(2) R. BOYLE : *New experiments physico-mechanicall, touching the spring of the air, and its effects (made for the most part in a new pneumatical engine)*. Oxford, 1660.

the *Philosophical Transactions* from 1705 on and then his *Physico-mechanical experiments on various subjects*... (London, 1709) (3). One of HAUKSBEE's first subjects of investigation was the "mercurial phosphorus" (i.e., the barometric glow above mentioned) and his main instrument was the air pump. He declared in his preface :

> "The Honourable and most Excellent Mr. BOYLE, by great Variety of Experiments, in almost *every Part* of *Philosophy*, gave much Light into the Causes and Operations of Nature; and particularly, by the Invention of that most Useful Instrument the *Air-Pump*." (p. A2v).

He begins his book with "a general description of the Air-Pump" (p. 1-5) and the first section of it is devoted to the "mercurial phophorus" (p. 6-20).

3. During the following century and a half the few humble electrical facts discovered by HAUKSBEE were considerably elaborated, and electrostatics, electromagnetism and electrodynamics reached a high degree of experimental and theoretical perfection.

In the meanwhile an old idea relative to the vacuum was being brought to maturity. The virtuosi who were working together in the Accademia del cimento of Florence (1657-66) had already thought of obtaining a better vacuum by the simple expedient of enlarging and utilizing the space left empty above the barometric mercury (4). That idea reappeared in improved form in SWEDENBORG's *Miscellanea observata* (Leipzig, 1722) (5) and in other writings. The first practical mercury pump was created by the glassblower and instrument maker HEINRICH GEISSLER in or about 1855. GEISSLER also made those tubes bearing his name by means of which it was possible to show the beautiful flashes of coloured light produced by the discharge of an induction coil (6) in rarefied gases. Observe the same combination of light, electricity and vacuum as in the early experiments of PICARD

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(3) The first edition is not available to me. My quotation below is from the second edition, London, 1719.

(4) *Saggi di naturali esperienze fatte nell'Accademia del cimento* (Firenze, 1667, p. LII).

(5) I have used the edition of the Swedish Academy of Sciences (Stockholm, vol. 1, 112, 1907). About that edition, see *Isis*, 23, 459.

(6) A very efficient induction coil had just been created in Paris by HEINRICH DANIEL RUHMKORFF, in 1851.

and HAUKSBEE. Old problems were being restaged on a higher experimental and intellectual plane.

4. From 1854 on, GEISSLER was glassblower at the university of Bonn, and JULIUS PLÜCKER (1801-68) was professor at the same institution. PLÜCKER was not only one of the most original and profound mathematicians of the last century, he was also a physicist of encyclopaedic curiosity. He became interested in GEISSLER's tubes and suggested a modified form wherein the luminous discharge could be confined to a capillary part in the middle. These modified tubes were often called " Plücker tubes", though he himself originated the name " Geissler tubes " and made them famous. By means of these tubes and the accessory instruments (GEISSLER pump, RUHMKORFF coil) he instituted a long series of experiments the results of which were published in the (POGGENDORFF's) *Annalen der Physik und Chemie* (vols. 103 to 116, 1858-62) (7). These papers appeared under various titles, the first being *Ueber die Einwirkung des Magneten auf die elektrischen Entladungen in verdünnten Gasen*, but their unity is evidenced by the fact that they are divided into 294 consecutively numbered chapters. As soon as he began his experiments PLÜCKER took far more interest in the spectra which he could observe in his GEISSLER tubes than in anything else, and he thus became one of the founders of spectral analysis. (8) However, he already noticed in his first paper (dated Bonn, 27 Dec. 1857, published 1858) that particles of the platinum cathode were carried to the glass of the tube, that the light streams could be deflected by magnetic force, that a part of the glass wall near the cathode became phosphorescent during the discharges and that the position of the phosphorescent spot varied when the magnetic field was modified. In other words PLÜCKER was the first to observe cathodic rays (without identifying them), and their deflection under magnetic influence.

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(7) Reprinted in PLÜCKER's *Gesammelte wissenschaftliche Abhandlungen* (vol. 2, 475-656, 1896). The first five papers were promptly translated in the *Philosophical Magazine* (vols. 16 and 18, 1858-9) and an English summary of the whole series, up to that time, appeared in the *Proceedings of the Royal Society* (vol. 10, 256-69, 1860). PLÜCKER's investigations were thus known to every alert physicist.

(8) HEINRICH KAYSER : Geschichte der Spectroscopie (in his great *Handbuch*, vol. 1, p. 3-128, Leipzig, 1900). According to KAYSER, PLÜCKER was one of the main forerunners of KIRCHHOFF and BUNSEN (p. 76).

PLÜCKER wrote to FARADAY :

"'Among the great number of observations I made on the electric discharge through different gaz vacua, there are very beautiful too reguarding fluorescent light, peculiarly of glass, which I wished to show you. I got for instance spheres of German glass which on their whole surface showed a nearly uniform green light, produced by a rather dark electric discharge within. By the magnet the fluorescent light is concentrated to determined places where the magnetic negative light touches the interior surface, in certain cases we get very well desined spirals of fluorescent light, characterising the positive light. There is no doubt with English glass containing lead, the same phenomena will appear in the finest blue light.'" (9).

5. The study of those mysterious phenomena proceeded at first very slowly—partly because the attention of physicists was more generally attracted to spectral analysis, partly because the degree of exhaustion of the Geissler tubes was not yet sufficient. We have to wait ten years for the next step forward, when one of PLÜCKER's earlier students, JOHANN WILH. HITTORF, increasing the vacuum of the tubes, observed the shadows of the rays when a screen was placed between the cathode and the phosphorescent spot, and concluded that their propagation was rectilinear (10). Similar experiments were made by CROMWELL FLEETWOOD VARLEY (11), who concluded that the rays consisted of "attenuated particles of matter projected from the negative pole by electricity in all directions, but that the magnet controls their course" (p. 239). The first to use the phrases cathodic light and cathodic rays (Kathodenlicht, Kathodenstrahlen) was, I believe, EUGEN GOLDSTEIN (*Monatsbericht der K. preuss. Akad.*, Berlin, 1876, 279-95).

6. To return to the vacuum, WILLIAM CROOKES (12) had succeeded in the meanwhile in obtaining a much higher vacuum —of the order of a millionth of an atmosphere—and recognizing

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(9) WILHELM ERNST : JULIUS PLÜCKER (Bonn 1933, p. 65; *Isis*, 24, 491). Unfortunalety ERNST does not give the date of that letter.

(10) W. HITTORF: Ueber die Elektricitätsleitung der Gase (*Poggendorff's Annalen*, vol. 136, 1-31, 197-234, 1869).

(11) Some experiments on the discharge of electricity through rarefied media and the atmosphere (*Proceedings of the Royal Society*, vol. 19, 236-40, 1871). This VARLEY was a spiritualist; it was he who turned CROOKES' curiosity to the scientific study of spiritualism (see CROOKES' life by FOURNIER D'ALBE, 1923, p. 133).

(12) E. E. FOURNIER D'ALBE : *The life of Sir William Crookes* (London 1923; *Isis*, 6, 549-53).

the peculiar qualities of gases rarefied to that extent, he spoke of having discovered a fourth state of aggregation (" radiant matter "). His writings " on attraction and repulsion resulting from radiation," which culminated in his Bakerian lecture of 1878 (13) gave a strong impulsion to the study of cathodic rays. He proved that they consisted of negatively charged particles, that they produced considerable heating if stopped, and he illustrated their mechanical action by means of the radiometer recently invented by himself (1875).

7. Not only were CROOKES' bold speculations controverted but even his (and VARLEY's) matter-of-fact conclusion that the cathodic rays consist of negatively charged particles was denied by such outstanding men as P. G. TAIT and HEINRICH HERTZ. However, the latter discovered a new fact of great pregnancy : the cathodic rays are able to penetrate thin metallic leaves and they issue from them in a state of diffusion, like light passing through a turbid medium, e.g., opal glass (1892) (14). This led PHILIPP LENARD to the construction of a new kind of Geissler tubes bearing aluminium windows through which the cathodic rays could diffuse (1894) (15). He investigated the properties of the issuing rays (" Lenard rays "), confirmed HERTZ' statement concerning their diffusion, e.g., he showed that their phosphorescent action depends on the distance but not on the direction of the object upon which they fall; they ionize the air and do not penetrate it except for a very short distance (about 2 cm.); they affect the photographic plate. Comparing their highly diffused state with the behaviour of light even of the smallest wavelength, he concluded that they must represent aether motions of extreme fineness within the range of molecular dimensions (*op. cit.*, p. 266).

8. The Herzian or Lenardian conception of cathodic rays as

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(13) *Philosophical Transactions* (vols. 164 to 166, 169, 170, 1874-79).

(14) H. HERTZ : Ueber den Durchgang der Kathodenstrahlen durch dünne Metallschichten (*Annalen der Physik*, vol. 45, 28-32, 1892). HERTZ begins his account as follows : " Die Kathodenstrahlen unterscheiden sich vom Lichte wesentlich in Hinsicht der Fähigkeit feste Körper zu durchdringen." For the story down to this point it is interesting to consult J. J. THOMSON : *Notes on ecent researches in electricity and magnetism, intended as a sequel to Professor* CLERK-MAXWELL's *treatise* (Oxford 1893).

(15) PHILIPP LENARD : Ueber Kathodenstrahlen in Gasen von atmosphärischem Druck und im äussersten Vacuum (*Annalen der Physik*, vol. 51, 225-67, 1894).

aethereal waves became untenable when J. J. THOMSON measured their speed by means of a rotating mirror and found that it was variable but always materially smaller than the speed of light (1894) (16), and when JEAN PERRIN in the following year proved experimentally that the cathodic rays were composed of negatively electrified particles (17). Finally in 1897, J. J. THOMSON was able to measure the ratio $\frac{m}{e}$ (mass to charge) of those particles. A similar result had been obtained independently and a little earlier by W. KAUFMANN (18).

9. We are going ahead of our story. Let us return to the Lenard rays which were the immediate link to RÖNTGEN's discovery. Working in his little laboratory of the university of Würzburg, RÖNTGEN made that memorable discovery on November 8, 1895. He at once realized its importance, but said nothing of it to his two assistants and the people around him, and continued his investigation of the new rays with as little interruption as possible. For a time he even ate and slept in his laboratory. His " preliminary communication " was completed on December 28, 1895 and immediately transmitted to the president of the Physikalisch-medicinische Gesellschaft of that city (see date at the beginning of our facsimile). It was promptly published in their *Sitzungsberichte* of the year 1895, though it seems hardly possible that it could be actually published within three days. It is highly probable that the date of publication is incorrect and that that part of the *Sitzungsberichte* did not actually appear until the first days of 1896 (19). By the way, it is interesting to note that our account of the RÖNTGEN discovery began with another Würzburg publication, SCHOTT's *Mechanica hydraulico-pneumatica* of 1657.

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(16) J. J. THOMSON : Velocity of the cathode rays (*Philosophical Magazine*, vol. 38, 358-64, Oct. 1894). $v = 2.10^7$ cm./sec. but in later experiments he found that $v > 10^9$. The speed of light is 3.10^{10} cm./sec.

(17) JEAN PERRIN : Nouvelles propriétés des rayons cathodiques (*Comptes rendus de l'Académie des sciences*, vol. 121, 1130-34, 1895).

(18) W. KAUFMANN : Die magnetische Ablenkbarkeit der Kathodenstrahlen und ihre Abhängigkeit vom Entladungspotential. Berlin, April 1897 (*Annalen der Physik*, vol. 61, 544-52, 1897). J. J. THOMSON : Cathode rays, Cambridge, Aug. 7, 1897 (*Philosophical Magazine*, vol. 44, 293-316, October 1897).

(19) When dealing with questions of priority it is the date of publication which counts, and by this is meant of course not the date printed on the book or periodical-

10. As we give below a photographic reproduction of the "Preliminary communication" wherein the account of RÖNTGEN's discovery may be read in his own words, (20) it is not necessary to describe it lengthily. However, a summary of it may be helpful.

Enveloping a very efficient vacuum tube (21) in a box and discharging a great Ruhmkorff coil through it, he noticed phosphorescent effects on a screen of barium platino-cyanide placed at some distance in the darkened room (even as far as 2 meters). He showed great ingenuity in his first investigations of the new rays and found that they were very different from the cathodic rays and also from the Lenard rays. They are considerably more penetrating than the latter, their amazing power of penetration being indeed their most startling property. Almost every substance is transparent to them down to a certain depth. They act upon photographic plates. There is no noticeable reflexion, refraction, polarization or interference. They cannot be deflected by a magnetic field. They seem to issue mainly from the part of the glass which is most fluorescent. When the cathodic rays are displaced by a magnetic field, the X-rays are also displaced, yet the fact that they themselves are not affected by the magnetic field proves that they are not simply reflected cathodic rays. Hence the X-rays are not cathodic rays but are produced by the latter. Their propagation is rectilinear, witness the shadows. They are unaffected by electrostatic forces. What are they? As they have points in common with light—formation of shadows, fluorescence and chemical action—are they not perhaps a kind of ultra-violet rays? or perhaps are they due to longitudinal

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number wherein the discovery was published, but the actual date of issuance of that book or number. Numbers of journal are often incorrectly dated, the printed date being sometimes anterior and sometimes posterior to the real one.

ROENTGEN's short paper may have been printed before the end of 1895, but it is very unlikely that it was published (distributed) before 1896. Says GLASSER (p. 28) RÖNTGEN's paper "was printed at once... and distributed during the first days of January 1896."

(20) Those who do not read German easily will find an English translation in *Nature* (53, 274-76, Jan. 23, 1896), in the *Electrician* (36, 415, Jan. 24, 1896), in *Science* (3, 227, Feb. 14, 1896) and in OTTO GLASSER's book (17-28, 1934). Other translations appeared also very promptly in French, Italian and Russian.

(21) The experiment can only succeed if the pressure is very low, so low that the walls are vividly phosphorescent when the tube is excited.

vibrations of the ether? (as opposed to the transversal vibration of light). The paper ends with these perplexing and fascinating queries which seemed to justify the name ROENTGEN had given to the mysterious rays: the X-rays.

11. The discovery was truly sensational, even more so than that of the first electric cell by VOLTA almost a century earlier (22), and there was this difference that the work of a generation of physicists with vacuum tubes and with cathodic rays had prepared the scientific public for its almost immediate appreciation. Moreover every physical laboratory being equipped with induction coils and Geissler tubes of one kind or another, it was easy to repeat, verify and modify at once in a hundred different places all over the civilized world ROENTGEN's simple experiments. As a result there appeared within the first year of his discovery (1896) no less than 49 books or pamphlets and 1044 papers on Roentgen rays! One could not give a better illustration of the speed of diffusion of scientific ideas, and of the oecumenic extent of that diffusion in modern times. Other illustrations are afforded by the fact that in that same golden year 1896 there were built at least 32 different models of Roentgen tubes, and a whole series of patents were taken in England, America, Germany, and France (23).

12. The development of our knowledge of X-rays and of radiology in general, and of their applications, medical and others, is so considerable, that I cannot think of telling it here, nor even of outlining it (24). I shall restrict myself to recalling the fundamental discovery which proved the real nature of the X-rays. We have seen above that at the end of his Preliminary communication ROENTGEN had already wondered whether those rays were not some kind of light rays of the ultra-violet type.

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(22) G. SARTON: The discovery of the electric cell (1800) (*Isis*, 15, 124-57, 1931; see p. 127).

(23) GLASSER (318, 351). See also the early advertisements of X-rays apparatus (ibidem, 356, etc.). "It is said", remarked F. K. RICHTMYER (*Science* 75, p. 2, 1932), "that within 48 hours after American newspapers had printed the cable dispatch reporting the discovery of X-rays, at least six X-ray photographs had been made in laboratories on this side of the water."

(24) To have a general idea of it consult, for example, HERMANN GOCHT: *Röntgen-Literatur* which began to appear in Stuttgart 1911, or ERICH MARX: *Handbuch der Radiologie*, which began to appear in 1920.

Before him, LENARD, speculating on his own rays, had wondered whether they were not aether waves of molecular dimensions (see above § 7, 10). As early as 1897 Sir GEORGE STOKES suggested that X-rays were a succession of pulses caused by the sudden stoppage of cathodic particles on a target (a theory which has been essentially substantiated) (25). The fact that X-rays were not affected by electric and magnetic fields, their speed appearing to equal that of light, their photo-electric action, all these characteristics confirmed ROENTGEN's first guess (a guess for which he deserves little credit however for he did not hold fast to it) and STOKES' theory. The absence of noticeable reflection, refraction, diffraction and polarisation effects could perhaps be explained by the extreme shortness of the waves?—In 1912, these tentative reflections were changed into certainties by MAX VON LAUE, who had the idea of using crystalline plates for the refraction and interference of X-rays, that is, of using the natural gratings due to crystalline structure, instead of artificial gratings, the finest of which were hopelessly coarse. The experimental proof of v. LAUE's theory was completed by W. FRIEDRICH and P. KNIPPING. These beautiful experiments established on an indisputable basis at one and the same time the regular sequences of molecules in crystals and the true nature of X-rays. These were proved to be rays of extremely high frequency (wave lengths of the order of 0.1 to 1.50 Ångström) (26). Abundant confirmations were added by the investigations of WILLIAM HENRY BRAGG and WILLIAM LAWRENCE BRAGG (father and son) on the geometric patterns of various crystalline substances, and by the astounding development of X-ray spectroscopy and its application to the enumeration of the atoms and to the elucidation of the periodic table (27).

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(25) Sir G. G. STOKES : On the nature of the Röntgen rays (*Memoirs of the Manchester literary and philosophical society*, vol. 41, 28 p., 1897). Wilde lecture delivered on July 2, 1897).

(26) The epoch making discovery of MAX v. LAUE, W. FRIEDRICH and P. KNIPPING was published in *Sitzungsber. der Bayer. Akad., math. Klasse* (1912, 303-22). This and later papers on the same subject by M. v. LAUE were reprinted in *Ostwald's Klassiker*, Nr. 204 (Leipzig 1923; *Isis* 5, 526).

(27) G. SARTON : MOSELEY. The numbering of the elements (*Isis* 9, 96-111 1927; p. 102-7).

13. RÖNTGEN's discovery may be said to mark the beginning of a new period, during which startling inventions and paradoxical revelations followed one another so thickly, that it became increasingly difficult for the specialist, and almost hopeless for the non-specialist, to keep abreast of the times, and that the philosophically minded historian of science was hardly able to digest, integrate, and appreciate correctly the new conquests. The year 1896 might well be taken as the opening year of modern physics, and we are now beginning to see the succession of its memorable events in its true perspective.

And yet there is no absolute beginning in science; or to put it otherwise, every beginning is also a climax. Indeed it is only because it is a climax—the clinching of a long series of efforts—that it can be the beginning of a new evolution on a higher level. This applies very well to RÖNTGEN's discovery. It was in the air when it was made, and if RÖNTGEN had not been available or had been less persistent and successful, the selfsame discovery would have been made sooner or later—and probably very soon—by LENARD or someone else.

Indeed RÖNTGEN did not create at first new apparatus. He used the same paraphernalia as were used by many physicists of his day: a Rühmkorff induction coil, Lenard and Hittorf-Crookes tubes (28). Even the barium platino-cyanide screen which played an important part in the detection of the new rays, had been used more than once to reveal invisible rays. Under those circumstances we would expect other experimenters using the same equipment to have produced X-rays before RÖNTGEN—and this was actually the case—but either they did not discover the rays which they produced, or they did not publish their discovery and only realized it after it had been published by RÖNTGEN. One of these unsuccessful forerunners was ARTHUR WILLIS GOODSPEED of Philadelphia, who not only produced X-rays but obtained accidentally the earliest "shadowgraph" (i.e., radiograph), in 1890. In a lecture made by him on February 22, 1896 he honestly declared:

"'We can claim no merit for the discovery, for no discovery was made. All we ask is that you remember, gentlemen, that six years ago, day for day, the first

(28) His original instruments may be seen in the Deutsches Museum, Munich.

picture in the world by cathodic rays was taken in the Physical Laboratory of the University of Pennsylvania.' " (29).

13bis. (Paragraph interpolated after the publication of Lord RAYLEIGH'S *Reminiscences* in April 1936). Lord RAYLEIGH'S presidential address "Some reminiscences of scientific workers of the past generation, and their surroundings" delivered before the Physical Society on Jan. 24, 1936 and printed in the *Proceedings* of that Society (vol. 48, 217-246, 1936) contains the following remarks which illustrate the "ripeness" of RÖNTGEN'S discovery at the time it was made :

"It was a source of great annoyance to CROOKES that the had missed the discovery of the X-rays. According to the account he gave in my hearing, he had definitely found previously unopened boxes of plates in his laboratory to be fogged for no assignable reason, and, acting I suppose in accordance with the usual human instinct of blaming semeone else when things go wrong, he complained to the makers, who naturally had no satisfactory explanation to offer. I believe it was only after RÖNTGEN'S discovery that he connected this with the use of highly exhausted vacuum tubes in the neighbourhood. He had, at least, less to reproach himself for than another English man of science, who, it was said, knew that high vacuum discharge tubes were apt to fog photographic plates anywhere near them, and only drew the moral that the plates should be stored elsewhere". (p. 240).

14. Much as they were startled by the announcement of his discovery, RÖNTGEN'S contemporaries realized that it was but the glorious fruit of many earlier efforts. To the translation of his " preliminary communication " were added in *Nature* (vol. 53, 276-7, Jan. 23, 1896) such reflexions as these (by A. A. C. SWINTON).

" The newspaper reports of Prof. RÖNTGEN'S experiments have, during the past few days, excited considerable interest. The discovery does not appear, however, to be entirely novel, as it was noted by HERTZ that metallic films are transparent to the kathode rays from a CROOKES or HITTORF tube, and in LENARD'S researches, published about two years ago, it is distinctly pointed out that such rays will produce photographic impressions. Indeed, LENARD, employing a tube with an aluminium window, through wich the kathode rays passed out with comparative ease, obtained photographic shadow images almost identical with those of RÖNTGEN, through pieces of cardboard and aluminium interposed between the window and the photographic plate.

" Prof. RÖNTGEN has, however, shown that this aluminium window is un-

(29) Of course his declaration was incorrect; the picture was taken, not by cathodic rays, but by X-rays; but he was right in his appreciation of what constitutes a scientific discovery. For other claims see chapter IX in GLASSER'S book (p. 222-8).

necessary, as some portion of the kathode radiations that are photographically active will pass through the glass walls of the tube. Further, he has extended the results obtained by LENARD in a manner that has impressed the popular imagination, while, perhaps most important of all, he has dicovered the exceedingly curious fact that bone is so much less transparent to these radiations than flesh and muscle, that if a living human hand be interposed between a CROOKES tube and a photographic plate, a shadow photograph can be obtained which shows all the outlines and joints of the bones most distinctly."

15. There is no doubt that the radiographs (30) of the bones of living persons added considerably to the popularity of RÖNTGEN's achievements. They provided the human touch—in this case a very intimate one —without which there is no real fame. Witness the commentaries in the newspapers, the abundant jokes and cartoons (31).

16. It would be wrong to conclude from the fact that his discovery was the logical sequence of previous ones, that RÖNTGEN was only a " lucky " fellow. He was undoubtedly lucky—we all need a modicum of luck to show our mettle and do our best—but he fully deserved his success, having prepared himself for it by a lifetime of ingenious and indefatigable research.

The main facts of his life can be outlined as follows (32). WILHELM CONRAD RÖNTGEN was born on March 27, 1845, at Lennep, near Barmen, in the Rhine province of Prussia; his father was a clothdealer who came from an old family of Lennep merchants; his mother and her mother were born in Amsterdam, but her father's family originated from the same Lennep country (in fact she and her husband were first cousins); WILHELM was an only child. The RÖNTGENS were Lutheran but his mother and her maternal ancestors belonged to the Reformed Church. When the child was three years old, his parents moved to Apeldoorn, in Gelderland, Netherlands. WILHELM studied in Apeldoorn, and did not distinguish himself except by his love of nature and his early interest in mechanical contrivances. He continued his studies in Utrecht and finished them in Zürich.

(30) X-ray photographs were made by RÖNTGEN in December 1895 and are mentioned in his first paper (p. 140, 14). Some of these early radiographs are preserved, e.g., a picture of a hand made by RÖNTGEN on Dec. 22, 1895 and sent by him to his old classmate FRANZ EXNER of Vienna (Deutsches Museum).

(31) Many amusing specimens may be found in GLASSER's book.

(32) Mainly derived from OTTO GLASSER's excellent work : W. C. RÖNTGEN (Springfield, Ill., 1934; *Isis* 22, 256-9).

It is interesting to note that his education took place entirely outside of Germany for he was absent from that country from his third to his twenty-third year (33). He obtained his diploma of mechanical engineer in Zürich 1868, and his Ph. D. in the same university 1869. Soon afterwards he became assistant to the great experimentalist AUGUST KUNDT—the teacher who influenced him most. In 1871, he followed KUNDT to Würzburg, and in 1872 he returned to Apeldoorn to marry ANNA BERTHA LUDWIG. They lived happily almost half a century together; they had no child but adopted a niece. RÖNTGEN was very fond of the country and spent most of his vacations in the Engadine, in the lake district of northern Italy, or later at Weilheim in the Bavarian Alps where he had bought himself a house.

To return to our account of RÖNTGEN's career, he went with KUNDT to the newly founded German university of Strasbourg in 1872 and was appointed privat-dozent two years later. He became professor at Hohenheim in 1875, then in Strasbourg, Giessen and Würzburg (1888), and finally Munich (1900). It was during the Würzburg episode—his golden age (Aet. 43-55), that he made the discovery which gave him international fame within an incredibly short time, and immortalized his name.

17. However, before that memorable date (1895) and after it, RÖNTGEN was engaged in a number of other investigations, some of which were quite important, though they were eventually overshadowed by the discovery of the X-rays. He conducted elaborate experiments in many directions: determination of the ratio of specific heats of gases, conductivity of heat in crystals, electro-magnetic rotation of the plane of polarization in gases, influence of pressure upon compressibility, capillarity, viscosity, and refraction of light, absorption of heat rays by steam, pyro- and piezo-electricity of crystals, etc.

"In 1888, he made his famous investigations to prove that magnetic effects are produced in a dielectric, such as a glass plate when it is moved between two electrically charged condenser plates. This work is one of his most important

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(33) Later he gradually lost the ability to speak Dutch, but when he visited H. A. LORENTZ in Leiden 1904 he brushed up on it for the occasion. His mission was to offer LORENTZ the chair of theoretical physics of Munich previously occupied by LUDWIG BOLTZMANN; LORENTZ declined and the chair was then offered to ARNOLD SOMMERFELD, who accepted it (1906).

investigations based upon the theoretical reasoning of the FARADAY-MAXWELL electro-magnetic theory. The results which he obtained were the ideal co-ordination of the functions of a theorist and those of a genius in experiment. It was because of the value of the connection between the theoretical conception of the problem and its experimental proof that RÖNTGEN himself regarded this ' roentgen current,' which was so named by H. A. LORENTZ, as being of as much importance as his discovery of the roentgen rays. SOMMERFELD stated, ' The roentgen current, together with the ROWLAND effect, forms an indispensable foundation for the conception that the dielectric properties of matter depend upon the presence of charges (electrons) and, in its later quantitative perfection, it decides directly against the original MAXWELL-HERTZ theory.' " " From the abnormal action of water as compared with other liquids, that is, its decrease of compressibility with increasing temperature, and decrease of internal friction through pressure, or through the increase of the thermal coefficient of expansion with pressure, he concluded that water consists of two types of molecules. These two types are : first, the ice molecules which cause a larger volume, and a second kind of molecules which are formed if the temperature increases and which cause a decrease in volume." (GLASSER, 83, 85.)

RÖNTGEN was essentially an experimentalist, a very ingenious, conscientious and thorough one, but he fully appreciated the importance of a sound theoretical basis without which experiments have no meaning. He would even go so far as to say " The physicist in preparing for his work needs three things, mathematics, mathematics, and mathematics."

18. More happy in this respect than COLUMBUS, RÖNTGEN lived long enough to know the true nature of his discovery and to measure its immensity. The experiments suggested by M. VON LAUE were made by W. FRIEDRICH and P. KNIPPING in SOMMERFELD's institute at the University of Munich, and RÖNTGEN repaired thither to see the radiographs recording them.

" 'I still can see RÖNTGEN as he carefully studied these pictures in my laboratory," said SOMMERFELD later. FRIEDRICH showed him the pictures and the apparatus, and after RÖNTGEN had studied them thoroughly and critically, he declared that he could find no experimental error. RÖNTGEN then sincerely congratulated FRIEDRICH on his important experimental results, but he added, ' I do not think that these are interference phenomena. They look different to me.' However, soon thereafter, he became convinced of the fact that these pictures actually represented the result of interferences of roentgen rays, especially after E. WAGNER and R. GLOCKER had made their investigations on the monochromatic character of the diffracted rays in his own institute and after the publication of the famous experiments of W. H. and W. L. BRAGG in England." (GLASSER, p. 81.)

If longevity gave him the great privilege of seeing his own life-work in its true perspective, this was bitterly compensated by the fact that he had to live through the hard war years, and

what was infinitely worse, to witness the ultimate defeat, utter collapse and demoralization of his country. He witnessed the occupation of the Rhineland by foreign armies, the communistic disorders of Munich, and the economic and moral ruin of everything that was dear to him. He was the first recipient of the Nobel prize of physics, and had bequeathed the proceeds of it to the University of Würzburg to be used in the interests of science, but that capital became worthless in the financial catastrophe. His native city, Lennep, issued emergency money bearing his portrait; and there are Röntgen notes of that kind for "Hundert Milliarden Mark"!

His wife died in 1919 after a long illness, and the remaining years of his own life were increasingly sad. He still made a few excursions to his beloved mountains, and continued his work almost until the end of his days, but darkness and sorrow were closing up around him. He died in Munich in 1923 in his seventy-eight year, and was buried with his wife and parents in Giessen.

The facsimile of his Preliminary communication given below was reproduced from the original, thanks to the courtesy of the Library of Congress.

April 1935. GEORGE SARTON.

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Am 28. Dezember wurde als Beitrag eingereicht

W. C. Röntgen: Ueber eine neue Art von Strahlen.

(Vorläufige Mittheilung.)

1. Lässt man durch eine *Hittorf*'sche Vacuumröhre, oder einen genügend evacuirten *Lenard*'schen, *Crookes*'schen oder ähnlichen Apparat die Entladungen eines grösseren *Ruhmkorff*'s gehen und bedeckt die Röhre mit einem ziemlich eng anliegenden Mantel aus dünnem, schwarzem Carton, so sieht man in dem vollständig verdunkelten Zimmer einen in die Nähe des Apparates gebrachten, mit Bariumplatincyanür angestrichenen Papierschirm bei jeder Entladung hell aufleuchten, fluoresciren, gleichgültig ob die angestrichene oder die andere Seite des Schirmes dem Entladungsapparat zugewendet ist. Die Fluorescenz ist noch in 2 m Entfernung vom Apparat bemerkbar.

Man überzeugt sich leicht, dass die Ursache der Fluorescenz vom Entladungsapparat und von keiner anderen Stelle der Leitung ausgeht.

2. Das an dieser Erscheinung zunächst Auffallende ist, dass durch die schwarze Cartonhülse, welche keine sichtbaren oder ultravioletten Strahlen des Sonnen- oder des elektrischen Bogenlichtes durchlässt, ein Agens hindurchgeht, das im Stande ist, lebhafte Fluorescenz zu erzeugen, und man wird deshalb wohl zuerst untersuchen, ob auch andere Körper diese Eigenschaft besitzen.

Man findet bald, dass alle Körper für dasselbe durchlässig sind, aber in sehr verschiedenem Grade. Einige Beispiele führe ich an. Papier ist sehr durchlässig:[1]) hinter einem eingebundenen Buch von ca. 1000 Seiten sah ich den Fluorescenzschirm noch deutlich leuchten; die Druckerschwärze bietet kein merkliches Hinderniss. Ebenso zeigte sich Fluorescenz hinter einem doppelten Whistspiel; eine einzelne Karte zwischen Apparat und Schirm gehalten macht sich dem Auge fast gar nicht bemerkbar. — Auch ein einfaches Blatt Stanniol ist kaum wahrzunehmen, erst nachdem mehrere Lagen über einander gelegt sind, sieht man ihren Schatten deutlich auf dem Schirm. — Dicke Holzblöcke sind noch durchlässig; zwei bis drei cm dicke Bretter aus Tannenholz absorbiren nur sehr wenig. — Eine ca. 15 mm dicke Aluminiumschicht schwächte die Wirkung recht beträchtlich, war aber nicht im Stande, die Fluorescenz ganz zum Verschwinden zu bringen. — Mehrere cm dicke Hartgummischeiben lassen noch Strahlen[1]) hindurch. — Glasplatten gleicher Dicke verhalten sich verschieden, je nachdem sie bleihaltig sind (Flintglas) oder nicht; erstere sind viel weniger durchlässig als letztere — Hält man die Hand zwischen den Entladungsapparat und den Schirm, so sieht man die dunkleren Schatten der Handknochen in dem nur wenig dunklen Schattenbild der Hand. — Wasser, Schwefelkohlenstoff und verschiedene andere Flüssigkeiten erweisen sich in Glimmergefässen untersucht als sehr durchlässig — Dass Wasserstoff wesentlich durchlässiger wäre als Luft habe ich nicht finden können. — Hinter Platten aus Kupfer, resp. Silber, Blei, Gold, Platin ist die Fluorescenz noch deutlich zu erkennen, doch nur dann, wenn die Plattendicke nicht zu bedeutend ist. Platin von 0.2 mm Dicke ist noch durchlässig; die Silber- und Kupferplatten können schon stärker sein. Blei in 1.5 mm Dicke ist so gut wie undurchlässig und wurde deshalb häufig wegen dieser Eigenschaft verwendet. — Ein Holzstab mit quadratischem Querschnitt (20 × 20 mm), dessen eine Seite mit Bleifarbe weiss angestrichen ist, verhält sich verschieden, je nachdem er zwischen Apparat und Schirm gehalten wird; fast vollständig wirkungslos, wenn die X-Strahlen parallel der angestrichenen Seite durchgehen, entwirft der Stab einen dunklen Schatten, wenn die Strahlen die Anstrichfarbe durchsetzen müssen. — In eine ähnliche Reihe, wie die Metalle, lassen sich ihre Salze, fest oder in Lösung, in Bezug auf ihre Durchlässigkeit ordnen.

[1]) Mit „Durchlässigkeit" eines Körpers bezeichne ich das Verhältniss der Helligkeit eines dicht hinter dem Körper gehaltenen Fluorescenzschirmes zu derjenigen Helligkeit des Schirmes, welcher dieser unter denselben Verhältnissen aber ohne Zwischenschaltung des Körpers zeigt.

[1]) Der Kürze halber möchte ich den Ausdruck „Strahlen" und zwar zur Unterscheidung von anderen den Namen „X-Strahlen" gebrauchen. Vergl. u. p. 140.

3. Die angeführten Versuchsergebnisse und andere führen zu der Folgerung, dass die Durchlässigkeit der verschiedenen Substanzen, gleiche Schichtendicke vorausgesetzt, wesentlich bedingt ist durch ihre Dichte: keine andere Eigenschaft macht sich wenigstens in so hohem Grade bemerkbar als diese.

Dass aber die Dichte doch nicht ganz allein massgebend ist, das beweisen folgende Versuche. Ich untersuchte auf ihre Durchlässigkeit nahezu gleichdicke Platten aus Glas, Aluminium, Kalkspath und Quarz; die Dichte dieser Substanzen stellte sich als ungefähr gleich heraus, und doch zeigte sich ganz evident, dass der Kalkspath beträchtlich weniger durchlässig ist als die übrigen Körper, die sich untereinander ziemlich gleich verhielten. Eine besonders starke Fluorescenz des Kalkspathes (vergl. u. pag. 135) namentlich im Vergleich zum Glas habe ich nicht bemerkt.

4. Mit zunehmender Dicke werden alle Körper weniger durchlässig. Um vielleicht eine Beziehung zwischen Durchlässigkeit und Schichtendicke finden zu können, habe ich photographische Aufnahmen (vergl u pag 135) gemacht, bei denen die photographische Platte zum Theil bedeckt war mit Stanniolschichten von stufenweise zunehmender Blätterzahl; eine photometrische Messung soll vorgenommen werden, wenn ich im Besitz eines geeigneten Photometers bin

5. Aus Platin, Blei, Zink und Aluminium wurden durch Auswalzen Bleche von einer solchen Dicke hergestellt, dass alle nahezu gleich durchlässig erschienen. Die folgende Tabelle enthält die gemessene Dicke in mm, die relative Dicke bezogen auf die des Platinbleches und die Dichte.

	Dicke	relat. Dicke	Dichte
Pt.	0,018 mm	1	21,5
Pb.	0,05 „	3	11,3
Zn.	0,10 „	6	7,1
Al.	3,5 „	200	2,6

Aus diesen Werthen ist zu entnehmen, dass keineswegs gleiche Durchlässigkeit verschiedener Metalle vorhanden ist, wenn das Produkt aus Dicke und Dichte gleich ist. Die Durchlässigkeit nimmt in viel stärkerem Masse zu, als jenes Product

6. Die Fluorescenz des Bariumplatincyanürs ist nicht die einzige erkennbare Wirkung der X-Strahlen. Zunächst ist zu erwähnen, dass auch andere Körper fluoresciren; so z. B. die als Phosphore bekannten Calciumverbindungen, dann Uranglas, gewöhnliches Glas, Kalkspath, Steinsalz etc.

Von besondererer Bedeutung in mancher Hinsicht ist die Thatsache, dass photographische Trockenplatten sich als empfindlich für die X-Strahlen erwiesen haben. Man ist im Stande manche Erscheinung zu fixiren, wodurch Täuschungen leichter ausgeschlossen werden; und ich habe, wo es irgend anging, jede wichtigere Beobachtung, die ich mit dem Auge am Fluorescenzschirm machte, durch eine photographische Aufnahme controllirt.

Dabei kommt die Eigenschaft der Strahlen, fast ungehindert durch dünnere Holz-, Papier- und Stanniolschichten hindurchgehen zu können, sehr zu Statten, man kann die Aufnahmen mit der in der Cassette, oder in einer Papierumhüllung eingeschlossenen photographischen Platte im beleuchteten Zimmer machen. Andererseits hat diese Eigenschaft auch zur Folge, dass man unentwickelte Platten nicht bloss durch die gebräuchliche Hülle aus Pappendeckel und Papier geschützt längere Zeit in der Nähe des Entladungsapparates liegen lassen darf.

Fraglich erscheint es noch, ob die chemische Wirkung auf die Silbersalze der photographischen Platte direct von den X-Strahlen ausgeübt wird. Möglich ist es, dass diese Wirkung herrührt von dem Fluorescenzlicht, das, wie oben angegeben, in der Glasplatte, oder vielleicht in der Gelatineschicht erzeugt wird. „Films“ können übrigens ebenso gut wie Glasplatten verwendet werden.

Dass die X-Strahlen auch eine Wärmewirkung auszuüben im Stande sind, habe ich noch nicht experimentell nachgewiesen; doch darf man wohl diese Eigenschaft als vorhanden annehmen, nachdem durch die Fluorescenzerscheinungen die Fähigkeit der X-Strahlen, verwandelt zu werden, nachgewiesen ist, und es sicher ist, dass nicht alle auffallenden X-Strahlen den Körper als solche wieder verlassen.

Die Retina des Auges ist für unsere Strahlen unempfindlich; das dicht an den Entladungsapparat herangebrachte Auge bemerkt nichts, wiewohl nach den gemachten Erfahrungen die im Auge enthaltenen Medien für die Strahlen durchlässig genug sein müssen.

7. Nachdem ich die Durchlässigkeit verschiedener Körper

Pulver und der cohärenten Substanz, sowohl bei der Beobachtung

gleiche Durchlässigkeit verschiedener Metalle vorhanden ist, wenn das Produkt aus Dicke und Dichte gleich ist. Die Durchlässigkeit nimmt in viel stärkerem Masse zu, als jenes Product

bemerkt nichts, wiewohl nach den gemachten Erfahrungen die im Auge enthaltenen Medien für die Strahlen durchlässig genug sein müssen.

7. Nachdem ich die Durchlässigkeit verschiedener Körper von relativ grosser Dicke erkannt hatte, beeilte ich mich, zu erfahren, wie sich die X-Strahlen beim Durchgang durch ein Prisma verhalten, ob sie darin abgelenkt werden oder nicht. Versuche mit Wasser und Schwefelkohlenstoff in Glimmerprismen von ca. 30° brechendem Winkel haben gar keine Ablenkung erkennen lassen weder am Fluorescenzschirm, noch an der photographischen Platte. Zum Vergleich wurde unter denselben Verhältnissen die Ablenkung von Lichtstrahlen beobachtet; die abgelenkten Bilder lagen auf der Platte um ca. 10 mm resp. ca. 20 mm von dem nicht abgelenkten entfernt. — Mit einem Hartgummi- und einem Aluminiumprisma von ebenfalls ca. 30° brechendem Winkel habe ich auf der photographischen Platte Bilder bekommen, an denen man vielleicht eine Ablenkung erkennen kann. Doch ist die Sache sehr unsicher, und die Ablenkung ist, wenn überhaupt vorhanden, jedenfalls so klein, dass der Brechungsexponent der X-Strahlen in den genannten Substanzen höchstens 1.05 sein könnte. Mit dem Fluorescenzschirm habe ich auch in diesem Fall keine Ablenkung beobachten können.

Versuche mit Prismen aus dichteren Metallen lieferten bis jetzt wegen der geringen Durchlässigkeit und der in Folge dessen geringen Intensität der durchgelassenen Strahlen kein sicheres Resultat.

In Anbetracht dieser Sachlage einerseits und andererseits der Wichtigkeit der Frage, ob die X-Strahlen beim Uebergang von einem Medium zum anderen gebrochen werden können oder nicht, ist es sehr erfreulich, dass diese Frage noch in anderer Weise untersucht werden kann, als mit Hülfe von Prismen. Fein pulverisirte Körper lassen in genügender Schichtendicke das auffallende Licht nur wenig und zerstreut hindurch in Folge von Brechung und Reflexion: erweisen sich nun die Pulver für die X-Strahlen gleich durchlässig, wie die cohärente Substanz — gleiche Massen vorausgesetzt — so ist damit nachgewiesen, dass sowohl eine Brechung als auch eine regelmässige Reflexion nicht in merklichem Betrage vorhanden ist. Die Versuche wurden mit fein pulverisirtem Steinsalz, mit feinem, auf electrolytischem Wege gewonnenem Silberpulver und dem zu chemischen Untersuchungen vielfach verwandten Zinkstaub angestellt; es ergab sich in allen Fällen kein Unterschied in der Durchlässigkeit der

Pulver und der cohärenten Substanz, sowohl bei der Beobachtung am Fluorescenzschirm, als auch auf der photographischen Platte.

Dass man mit Linsen die X-Strahlen nicht concentriren kann, ist nach dem Mitgetheilten selbstverständlich; eine grosse Hartgummilinse und eine Glaslinse erwiesen sich in der That als wirkungslos. Das Schattenbild eines runden Stabes ist in der Mitte dunkler als am Rande; dasjenige einer Röhre, die mit einer Substanz gefüllt ist, die durchlässiger ist als das Material der Röhre, ist in der Mitte heller als am Rande.

8. Die Frage nach der Reflexion der X-Strahlen ist durch die Versuche des vorigen Paragraphen als in dem Sinne erledigt zu betrachten, dass eine merkliche regelmässige Zurückwerfung der Strahlen an keiner der untersuchten Substanzen stattfindet. Andere Versuche, die ich hier übergehen will, führen zu demselben Resultat.

Indessen ist eine Beobachtung zu erwähnen, die auf den ersten Blick das Gegentheil zu ergeben scheint. Ich exponirte eine durch schwarzes Papier gegen Lichtstrahlen geschützte photographische Platte, mit der Glasseite dem Entladungsapparat zugewendet, den X-Strahlen; die empfindliche Schicht war bis auf einen frei bleibenden Theil mit blanken Platten aus Platin, Blei, Zink und Aluminium in sternförmiger Anordnung bedeckt. Auf dem entwickelten Negativ ist deutlich zu erkennen, dass die Schwärzung unter dem Platin, dem Blei und besonders unter dem Zink stärker ist, als an den anderen Stellen; das Aluminium hatte gar keine Wirkung ausgeübt. Es scheint somit, dass die drei genannten Metalle die Strahlen reflectiren; indessen wären noch andere Ursachen für die stärkere Schwärzung denkbar, und um sicher zu gehen, legte ich bei einem zweiten Versuch zwischen die empfindliche Schicht und die Metallplatten ein Stück dünnes Blattaluminium, welches für ultraviolette Strahlen undurchlässig, dagegen für die X-Strahlen sehr durchlässig ist. Da auch jetzt wieder im Wesentlichen dasselbe Resultat erhalten wurde, so ist eine Reflexion von X-Strahlen an den genannten Metallen nachgewiesen.

Hält man diese Thatsache zusammen mit der Beobachtung, dass Pulver ebenso durchlässig sind, wie cohärente Körper, dass weiter Körper mit rauher Oberfläche sich beim Durchgang der X-Strahlen, wie auch bei dem zuletzt beschriebenen Versuch ganz gleich wie polirte Körper verhalten, so kommt man zu der Anschauung, dass zwar eine regelmässige Reflexion, wie gesagt, nicht statt-

findet, dass aber die Körper sich den X-Strahlen gegenüber ähnlich verhalten, wie die trüben Medien dem Licht gegenüber.

Da ich auch keine Brechung beim Uebergang von einem Medium zum anderen nachweisen konnte, so hat es den Anschein, als ob die X-Strahlen sich mit gleicher Geschwindigkeit in allen Körpern bewegen, und zwar in einem Medium, das überall vorhanden ist, und in welchem die Körpertheilchen eingebettet sind. Die letzteren bilden für die Ausbreitung der X-Strahlen ein Hinderniss und zwar im Allgemeinen ein desto grösseres, je dichter der betreffende Körper ist.

9. Demnach wäre es möglich, dass auch die Anordnung der Theilchen im Körper auf die Durchlässigkeit desselben einen Einfluss ausübte, dass z. B. ein Stück Kalkspath bei gleicher Dicke verschieden durchlässig wäre, wenn dasselbe in der Richtung der Axe oder senkrecht dazu durchstrahlt wird. Versuche mit Kalkspath und Quarz haben aber ein negatives Resultat ergeben.

10. Bekanntlich ist *Lenard* bei seinen schönen Versuchen über die von einem dünnen Aluminiumblättchen hindurchgelassenen *Hittorf*'schen Kathodenstrahlen zu dem Resultat gekommen, dass diese Strahlen Vorgänge im Aether sind, und dass sie in allen Körpern diffus verlaufen. Von unseren Strahlen haben wir Aehnliches aussagen können.

In seiner letzten Arbeit hat *Lenard* das Absorptionsvermögen verschiedener Körper für die Kathodenstrahlen bestimmt und dasselbe u. a. für Luft von Atmosphärendruck zu 4,10, 3,40, 3,10 auf 1 cm bezogen gefunden, je nach der Verdünnung des im Entladungsapparat enthaltenen Gases. Nach der aus der Funkenstrecke geschätzten Entladungsspannung zu urtheilen, habe ich es bei meinen Versuchen meistens mit ungefähr gleichgrossen und nur selten mit geringeren und grösseren Verdünnungen zu thun gehabt. Es gelang mir mit dem *L. Weber*'schen Photometer — ein besseres besitze ich nicht — in atmosphärischer Luft die Intensitäten des Fluorescenzlichtes meines Schirmes in zwei Abständen — ca. 100 resp. 200 mm — vom Entladungsapparat mit einander zu vergleichen, und ich fand aus drei recht gut mit einander übereinstimmenden Versuchen, dass dieselben sich umgekehrt wie die Quadrate der resp. Entfernungen des Schirmes vom Entladungsapparat verhalten. Demnach hält die Luft von den hindurchgehenden X-Strahlen einen viel kleineren Bruchtheil zurück als von den Kathodenstrahlen. Dieses Resultat

18. Diese Erzeugung findet nicht nur in Glas statt, sondern, wie ich an einem mit 2 mm starkem Aluminiumblech abgeschlos-

ist auch ganz in Uebereinstimmung mit der oben erwähnten Beobachtung, dass das Fluorescenzlicht noch in 2 m Distanz vom Entladungsapparat wahrzunehmen ist.

Aehnlich wie Luft verhalten sich im Allgemeinen die anderen Körper: sie sind für die X-Strahlen durchlässiger als für die Kathodenstrahlen

11. Eine weitere sehr bemerkenswerthe Verschiedenheit in dem Verhalten der Kathodenstrahlen und der X-Strahlen liegt in der Thatsache, dass es mir trotz vieler Bemühungen nicht gelungen ist, auch in sehr kräftigen magnetischen Feldern eine Ablenkung der X-Strahlen durch den Magnet zu erhalten.

Die Ablenkbarkeit durch den Magnet gilt aber bis jetzt als ein characteristisches Merkmal der Kathodenstrahlen; wohl ward von *Hertz* und *Lenard* beobachtet, dass es verschiedene Arten von Kathodenstrahlen gibt, die sich durch „ihre Phosphorescenzerzeugung, Absorbirbarkeit und Ablenkbarkeit durch den Magnet von einander unterscheiden", aber eine beträchtliche Ablenkung wurde doch in allen von ihnen untersuchten Fällen wahrgenommen, und ich glaube nicht, dass man dieses Characteristicum ohne zwingenden Grund aufgeben wird.

12. Nach besonders zu diesem Zweck angestellten Versuchen ist es sicher, dass die Stelle der Wand des Entladungsapparates, die am stärksten fluorescirt, als Hauptausgangspunkt der nach allen Richtungen sich ausbreitenden X-Strahlen zu betrachten ist. Die X-Strahlen gehen somit von der Stelle aus, wo nach den Angaben verschiedener Forscher die Kathodenstrahlen die Glaswand treffen. Lenkt man die Kathodenstrahlen innerhalb des Entladungsapparates durch einen Magnet ab, so sieht man, dass auch die X-Strahlen von einer anderen Stelle, d. h. wieder von dem Endpunkte der Kathodenstrahlen ausgehen.

Auch aus diesem Grund können die X-Strahlen, die nicht ablenkbar sind, nicht einfach unverändert von der Glaswand hindurchgelassene resp. reflectirte Kathodenstrahlen sein. Die grössere Dichte des Glases ausserhalb des Entladungsgefässes kann ja nach *Lenard* für die grosse Verschiedenheit der Ablenkbarkeit nicht verantwortlich gemacht werden.

Ich komme deshalb zu dem Resultat, dass die X-Strahlen nicht identisch sind mit den Kathodenstrahlen, dass sie aber von den Kathodenstrahlen in der Glaswand des Entladungsapparates erzeugt werden.

violettes Licht sein sollten, so müsste dieses Licht die Eigenschaft haben:

Schirmes vom Entladungsapparat verhalten. Demnach hält die Luft von den hindurchgehenden X-Strahlen einen viel kleineren Bruchtheil zurück als von den Kathodenstrahlen. Dieses Resultat

18. Diese Erzeugung findet nicht nur in Glas statt, sondern, wie ich an einem mit 2 mm starkem Aluminiumblech abgeschlossenen Apparat beobachten konnte, auch in diesem Metall. Andere Substanzen sollen später untersucht werden.

14. Die Berechtigung, für das von der Wand des Entladungsapparates ausgehende Agens den Namen „Strahlen" zu verwenden, leite ich zum Theil von der ganz regelmässigen Schattenbildung her, die sich zeigt, wenn man zwischen den Apparat und den fluorescirenden Schirm (oder die photographische Platte) mehr oder weniger durchlässige Körper bringt.

Viele derartige Schattenbilder, deren Erzeugung mitunter einen ganz besonderen Reiz bietet, habe ich beobachtet und theilweise auch photographisch aufgenommen; so besitze ich z. B. Photographien von den Schatten der Profile einer Thüre, welche die Zimmer trennt, in welchen einerseits der Entladungsapparat, andererseits die photographische Platte aufgestellt waren; von den Schatten der Handknochen; von dem Schatten eines auf einer Holzspule versteckt aufgewickelten Drahtes; eines in einem Kästchen eingeschlossenen Gewichtssatzes; einer Bussole, bei welcher die Magnetnadel ganz von Metall eingeschlossen ist; eines Metallstückes, dessen Inhomogenität durch die X-Strahlen bemerkbar wird; etc.

Für die geradlinige Ausbreitung der X-Strahlen beweisend ist weiter eine Lochphotographie, die ich von dem mit schwarzem Papier eingehüllten Entladungsapparat habe machen können; das Bild ist schwach aber unverkennbar richtig.

15. Nach Interferenzerscheinungen der X-Strahlen habe ich viel gesucht, aber leider, vielleicht nur in Folge der geringen Intensität derselben, ohne Erfolg.

16. Versuche, um zu constatiren, ob elektrostatische Kräfte in irgend einer Weise die X-Strahlen beeinflussen können, sind zwar angefangen aber noch nicht abgeschlossen.

17. Legt man sich die Frage vor, was denn die X-Strahlen, — die keine Kathodenstrahlen sein können — eigentlich sind, so wird man vielleicht im ersten Augenblick, verleitet durch ihre lebhaften Fluorescenz- und chemischen Wirkungen, an ultraviolettes Licht denken. Indessen stösst man doch sofort auf schwerwiegende Bedenken. Wenn nämlich die X-Strahlen ultra-

nicht identisch sind mit den Kathodenstrahlen, dass sie aber von den Kathodenstrahlen in der Glaswand des Entladungsapparates erzeugt werden.

violettes Licht sein sollten, so müsste dieses Licht die Eigenschaft haben:

a) dass es beim Uebergang aus Luft in Wasser, Schwefelkohlenstoff, Aluminium, Steinsalz, Glas, Zink etc. keine merkliche Brechung erleiden kann,

b) dass es von den genannten Körpern nicht merklich regelmässig reflectirt werden kann;

c) dass es somit durch die sonst gebräuchlichen Mittel nicht polarisirt werden kann;

d) dass die Absorption desselben von keiner anderen Eigenschaft der Körper so beeinflusst wird als von ihrer Dichte.

Das heisst, man müsste annehmen, dass sich diese ultravioletten Strahlen ganz anders verhalten, als die bisher bekannten ultrarothen, sichtbaren und ultravioletten Strahlen.

Dazu habe ich mich nicht entschliessen können und nach einer anderen Erklärung gesucht.

Eine Art von Verwandtschaft zwischen den neuen Strahlen und den Lichtstrahlen scheint zu bestehen, wenigstens deutet die Schattenbildung, die Fluorescenz und die chemische Wirkung, welche bei beiden Strahlenarten vorkommen, darauf hin. Nun weiss man schon seit langer Zeit, dass ausser den transversalen Lichtschwingungen auch longitudinale Schwingungen im Aether vorkommen können und nach Ansicht verschiedener Physiker vorkommen müssen. Freilich ist ihre Existenz bis jetzt noch nicht evident nachgewiesen, und sind deshalb ihre Eigenschaften noch nicht experimentell untersucht.

Sollten nun die neuen Strahlen nicht longitudinalen Schwingungen im Aether zuzuschreiben sein?

Ich muss bekennen, dass ich mich im Laufe der Untersuchung immer mehr mit diesem Gedanken vertraut gemacht habe und gestatte mir dann auch diese Vermuthung hier auszusprechen, wiewohl ich mir sehr wohl bewusst bin, dass die gegebene Erklärung einer weiteren Begründung noch bedarf.

Würzburg. Physikal. Institut der Universität. Dec. 1895.

The date of the earliest Latin-Arabic glossary

(Leiden : Cod. 231 Scal.)

The earliest Latin-Arabic Glossary (Leiden, *Cod. 231 Scal.*), cited in Dr. SARTON's *Introduction to the History of Science* (1) was dated by its editor, C. F. SEYBOLD (2), in the eleventh century. I have not seen the manuscript in question, but the one folio reproduced in SEYBOLD's publication seems to undermine the validity of his dating, and suggest that the Glossary is earlier than the eleventh century.

SEYBOLD's arguments for this dating were as follows : " Ex ductu characteris Visigothici ab octavo usque ad duodecimum p. Chr. n. saeculum satis constanti ac sibi admodum consimili, itemque ex ductu Arabico maghrebinico (vel occidentali, Afro-Hispanico) nil, ut nobis quidem videtur, certi conicere licet de antiquitate codicis nostri, qui apographon admodum accuratum autographo quasi coaequale videtur esse. At pergamenae cum charta quam dicunt bombycinam coniunctio—duo enim folia pergamena semper hic sequuntur quinque folia chartacea, ita ut sint 42 pergamena, 103 chartacea—ante saeculum undecimum non invenitur chartae usu tum demum ab Arabibus in occidentem translato. Librum igitur ipsum et codicem nostrum ad saeculum undecimum pertinere mihi probabilissimum esse videtur " (3).

In 1900 there were few criteria for dating examples of Visigothic minuscule on internal evidence, but the subsequent publications

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(1) (Washington : Cargenie Institution, 1927), I, 783.

(2) *Glossarium Latino-Arabicum, ex unico qui exstat codice Leidensi undecimo saeculo in Hispania conscripto* (Berlin, 1900). Heft 15-17 of *Ergänzungshefte zur Zeitschrift für Assyriologie. Semitistische Studien.*

(3) Op. cit., pp. ix-x.

of CHARLES UPSON CLARK (4), Z. GARCÍA VILLADA (5), AGUSTIN MILLARES CARLO (6), and in particular of E. A. LOWE (7), have invalidated SEYBOLD's belief that the script offers no exact clue to the age of the manuscript. Dr. LOWE's study of the manner of writing *ti* in Visigothic manuscripts (8) led to the following chronological conclusions :

" 1. The distinction is never found in MSS which are indisputably of the 8th or early 9th century.

2. The distinction is invariably made in the more recent MSS, beginning (to use the safest limits) with the second half of the 10th century and extending to the 12th, i.e., as long as the script lasts.

3. Certain MSS, written between the two periods indicated show a wavering in usage, one scribe making the distinction and another not; or one scribe making it in some cases and not in others " (9).

Now, as C. U. CLARK pointed out (10), in SEYBOLD's reproduction of fol. 140 of *Cod.* 231 *Scal.* the *ti* ligature is not found, and the ordinary forme of the letters *t* and *i* are used in cases of assibilitated sound (dilectionis, sapientie, diuitie). By application of Dr. LOWE's conclusions, a manuscript with this use would not be later than the middle of the tenth century, and CLARK (11) suggested (from the study of SEYBOLD's facsimile) that it might be as early as the end of the ninth century.

SEYBOLD's ascription of *Cod.* 231 *Scal.* to the eleventh century rests substantially upon the use of paper in the manuscript. However, a Latin Glossary from Santo Domingo de Silos, now in the Bibliothèque Nationale in Paris (*nouv. acq. lat.* 1296), which has been assigned on palaeographical evidence to the tenth

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(4) " Collectanea Hispanica," *Transactions of the Connecticut Academy of Arts and Sciences*, XXIV (1920), 1-243.

(5) *Paleografía Española* (Madrid : Centro de Estudios Históricos, 1923).

(6) *Tratado de Paleografía Española* (2nd ed., Madrid : V. SUAREZ, 1932).

(7) " Studia Palaeographica," *Sitzungsberichte d. kgl. Bayerischen Akademie d. Wissensch.*, phil.-hist. Kl., 1910, Nr. 12.

(8) That is, the normal forms of *t* and *i* for the unassibilitated, and a special ligature for the assibilitated use of the letters.

(9) Op. cit., p. 78.

(10) Op. cit., p. 37.

(11) Ibid.

century (12), is written on 28 folios of parchment and 194 of paper (13). Parchment was used for the outer leaves of the gatherings, and paper otherwise. SEYBOLD's description of *Cod.* 231 *Scal.*, with 42 parchment and 103 paper folios, seems to point to a similar arrangement. In any case, *nouv. acq. lat.* 1296 furnishes sufficient evidence of the use of paper in Spain in the tenth century to disprove SEYBOLD's contention that *Cod.* 231 *Scal.* cannot, because of its use of paper, be earlier than the eleventh century.

The exact date of *Cod.* 231 *Scal.* cannot, of course, be determined without a careful study of the manuscript. I merely wish to point out here that paper was used in Spain earlier than SEYBOLD believed, and that the Visigothic minuscule, on the one folio which he reproduced, has some of the characteristics of pre-eleventh century writing. There is, then, a good possibility that the earliest known Latin-Arabic Glossary is at least as old as the tenth century, and a certainty that the question deserves further investigation.

WALTER MUIR WHITEHILL.

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(12) LOWE, op. cit., p. 72; CLARK, op. cit., p. 53; GARCÍA VILLADA, op. cit., p. 118.

(13) This manuscript, described by F. DE BERGANZA, *Antiguëdades de España* (Madrid, 1721), II, 204, was discussed in GERARD MEERMAN's correspondence on the history of paper: J. VAN VAASSEN, ed., *Gerardi Meerman et doctorum virorum ad eum epistolae atque observationes de chartae vulgaris seu lineae origine* (The Hague, 1767), 5-6, 49 ff. It was one of the paper manuscripts examined by C. M. BRIQUET, "Recherches sur les premiers papiers employés en occident et en orient du X^e^ au XIV^e^ siècle," *Mémoires de la Société Nationale des Antiquaires de France*, XLVI (1885), 133-205. Through careless copying from MEERMAN's correspondence, it masquerades in AUGUSTIN BLANCHET's *Essai sur l'histoire du papier et de sa fabrication* (Paris, 1900), p. 50, as "le fameux manuscrit du couvent de San Gilos," and this error has been perpetuated by uncritical copying from BLANCHET in R. H. CLAPPERTON's *Paper: a Historical Account of its Making by hand* (Oxford: Shakespeare Head Press, 1934), 71-3.

Outline of the history of American cartography

American geographers and cartographers are but little aware of the work of their predecessors. This may be explained partly by the forward looking attitude of the American mind, or perhaps by the lack of comprehensive work on the subject. But it is certainly not due to the assumption that the work of the early American geographers and cartographers has been negligible. The subject is indeed of such magnitude that only a barest outline can be given within this article.

The map of America has been gradually built up through the centuries. The early charts of the Spanish, Italian, Dutch, French, and English navigators, and the maps of the explorers and army officers, however important, are American in their subjects only. Their maps were engraved and published in Europe. They are not discussed here, but the student is referred to the excellent works of JUSTIN WINSOR or the much simplified discussion of FIFE and FREEMAN or PAULLIN and WRIGHT.

1. COLONIAL CARTOGRAPHY (1670-1780)

It is somewhat surprising how few colonial maps survived which were made in America. The walls of colonial mansions were likely to be decorated with maps, but these came from the offices of JEFFERYS in London or D'ANVILLE in Paris. Map making in America was regarded primarily as a task of the army and navy; civil maps rarely went beyond delineations of estates, city plans, and a few state maps.

The first map compiled, drawn, engraved, printed, and published in America seems to be one of New England made by JOHN FOSTER, the first Boston printer, in 1677. It is a crude woodcut.

TIMECHARTS OF HISTORICAL CARTOGRAPHY

UNITED STATES

SURVEYS, OFFICIAL MAPS

EARLIEST STATE SURVEYS

Conn: by Garden • Kellock '37 Moses Park 4⁷⁄₈″ 21×29 1766
Conn:Mass. coast: Helme • Chandler '42
Va - N.C. boundary survey '28-'49, N.C. by Capt Collet 28°43″ '70 N.C. and S.C. by H. Mouzon 39°56″ 1775
Va • Md: Josua FRY • Th. P. Jefferson publ by Faden '51 31″48″
Penn: by Nickolas SCULL map by his son Wm. engr. by James Turner 27°32″ publ. 1770
N.H.: Mitchell • Hassen '70 . S. Langdon '56 Bernard Romans: charts of Florida and Gulf Coast

BRITISH MILITARY SURVEYS preserved mostly in Jeffery's and Le Rouge Atlases

Samuel HOLLAND surveyor general. Surveys of the New England coast . N.Y. State
COAST CHARTS: Joshua Fisher: Delaware Bay '56 Gascoine: S.C. • Ga. G Gould: Ala-Miss R. 64-7
Jonathan Carver, surveys in Canada esp. in Quebec and Ontario
Lt. Ross: survey of Mississippi R. from St Louis to Gulf '65
Wm. Brassier: L. Champlain region 1¹⁄₁₆″⁄ₘ 19×26″ publ. Sayer • Bennett London '76
J. MONTRESOR: many surveys between Montreal • Albany N.Y state '75
John Hill surveys in N.J. later civil surveyor, map of N.J. and Pa.
Collection of BRITISH HEADQUARTERS MAPS, mostly manuscript in Clements Library, Ann Arbor, Mich

WASHINGTON'S SURVEYORS

Rob't. Erskine died '80. Geographer in Chief. N.J. surveys ms.
Simeon Dewitt { Asst Geographer. Ms. maps of campaignes. N.Y. State: map 1802
Surv. General of N.Y. 1804. Meteorological charts
THOM. HUTCHINS 1730-1818 { Topogr. description of Va, Pa, Md • N.C. London '78
Geographer to U.S. '81. Org. of PUBLIC LAND SURVEY '85
Wm. Mc Murry Asst Geogr Map of U.S. 100⁄ₘ '84
Abraham Bradley: Post roads of U.S. 30⁄ₘ 1796 on, until 1829

WEST COAST

La Perouse expl. 85-88. Atlas '99. — Vancouver's expl. '92-'94 map '98
Spanish Admiralty Atlas, by Langara, Valdes and others 1801.

STATE MAPS

LEWIS • CLARK { expl. '04-'06 map by Clark '10 publ '14
Z. Pike expl { Rocky Mts. Sources of Miss. R. } maps '10
Wm. Lambert longitude of Capitol '09

U.S. Coast Survey founded '07, organized by Ferdinand Hassler: polyconic projection '20
Major Long: Atlas of Platte R. Phila. '22

J.C. Brown Orange - Taos Road survey '25-'27
R. Richardson Little Rock - Ft Gibson " '26

Lt. Allen, H.R. Schoolcraft } surveys of Upper Miss. R. 5½⁄ₘ '34

B.L.E. BONNEVILLE map of Great Basin '37
Ch. WILKES { Antarctic exp. '38-'42. Columbia R. survey
Atlases '44, '50-'58.

J.N. NICOLLET: survey of Minnesota - use of barometer '36-'43
U.S. ASTRONOMICAL OBSERVATORY '42

J.C. FRÉMONT map of the West 1:3,000,000, drawn Ch. Preuss '48. (main map of immigrants)

G.K. WARREN Transcontinental Ry survey '52-'57, map of West 1:3,000,000
Mexican Boundary Survey '55-'56

Prewar surveys (mostly in Mo.): Lt. IVES. Colorado R. Gc Canyon - Yuma publ. Macomb San Juan Mts. Colo.
Capt. Reynolds Yellowstone R. —— G.K. Warren Dakotas and Nebraska

CIVIL WAR { Confederate mapping under G'l Gilmer and Major Campbell
Union " " Jedidiah Hopkins

ARMY SURVEYS maps of forts, canals, railways, etc

THE GREAT WESTERN SURVEYS (organized into U.S. GEOL. S.)

California survey under J. D. Whitney maps 6⁄ₘ '76 on.
Clarence KING & J.D. Gardner etc 40th Parallel Survey 86,000 sq miles, Army } maps 4⁄ₘ and
G.M. WHEELER • G.K. Gilbert • I.C. Russel etc. W of 100° " 300,000 " " } 8⁄ₘ
J.W. POWELL • C.E. Dutton etc. ROCKY MT Region (Colo R.) 67,000 " D. of Inter. } Atlases lithogr.
F.W. HAYDEN • Wm.H. HOLMES etc. Geol. S. of Territories 100,000 " Land Off. } by Julius Bien

'79 Cl. KING director
'81 J.W. Powell "
'82 Topographic sheets at U.S. 1-4⁄ₘ
'84 Cooperative mapping of Mass.
'88 Engraving and printing
'90 Powell irrigation survey
'94 Water supply surveys
'94 Ch. Walcott director
'95 Geol. Atlases started
'97 Forest Reserve surveys

U.S. GEOL. S.

Extensive surveys under C.E. Dutton, G.K. Gilbert, C.H. Hitchcock, Wm Holmes, I.C. Russel, S.F. Emmons, Bailey Willis, C.R. Van Hise, N.H. Darton, A. Keith, M.R. Campbell, Henry Gannet chief topographer, W.C. Mendenhall, W.C. Alden, E.M. Douglas, F. Leverett, A.H. Brooks, G.R. Mansfield, T.C. Chamberlin, C.W. Hayes, S.S. Gannett (top. tables)

Mexico - Canada Ry. survey '95-'98
Census Bureau. Statistical Atlases since 1874
CUBA 1⁄ₘ maps. U.S. Engineers 1906-'08.
P.L. Phillips Library of Congress, Studies in cartography

U.S.G.S. { Hawaii Survey 1910 | Western arid regions A.E. Meinzer, D.G. Thompson, K. Bryan
Canal Zone " '12 | Alaska R.H. Sargent.
F.E. MATTHEWS. Grand Canyon '06. Yosemite Valley '30

V.C. Finch: Geography of World Agriculture Atlas '17
WORLD WAR. Great production of war maps, trench maps. Establishm. of military grid system
Atlas of American Agriculture, since '18. Meteorology, crops etc.
World Atlas of Commercial Geology 1921
O.E. Baker: Graphic summary of Am. Agriculture '31
Alaskan Boundary maps 1:250,000 1928 jointly with Canada

AIRPLANE SURVEYS

Miss. R. maps 1⁄ₘ new series.
Airway maps 1:500,000 U.S. Coast • G.S. Hydrog. Off. and Army jointly
Alaska forest survey. Atlantic coast, Miss. delta, Tennessee R.
Panamerican Highway survey
New LAND USE map of U.S. started 1:20,000 & 1:31,680 planimetric

LAND OFFICE since 1776. surveys of public lands, mostly 2⁄ₘ Atlas '76. State maps 1:500,000

Me.: Moses Greenlaw 8⁄ₘ 16×16-1829
N.H.: Philip Carrigain. 60×46″ 1816
Vt.: James Whitelaw 1⁄ₘ 1796. 1821
Mass: Osgood Carleton 4⁄ₘ 1801 { triang Borden • Saint 30 Atlas 2½⁄ₘ
Conn: Warren • Gillet 1:48″ '13
R.I.: Ch. Blaskowitz 1:48″ '11. Caleb Harris '96
N.Y.: { C.J. Sauthier 76-79, 4⁄ₘ. Sim. Dewitt 02.
David H. Burr Atlas 2⁄ₘ. '29
N.J.: Th. Gordon 3⁄ₘ '28
Pa.: { Reading Howell 38×64″ '92
John Melish 50×74, 8 maps '23
Md.: Dennis Griffith 5⁄ₘ '94
Va.: { James Madison 57×68 '18 } geol. W.B. Rogers
H. Boye 60×93 '26. 580,000 15″-41
N.C.: Price • Strother 20×60 '08 - Brazier '33
S.C.: John Wilson 6⁄ₘ '22. 300,000
Ga.: Daniel Sturges 44×56 '18
Ala.: John Eaton (G'l Land Off.)
La.: Ala: Wm Darby
Fla.: Vignoles '23 T.M. Gassel
Tenn: J.H. Bills
Ky.: L. Munsell. 38×91 '18
Ohio. Ind. Ill: G'l Land Surveys.
Sam. Williams • others
Mich { Orange Risdon (part) 41×47″ '25
J. Farmer 8⁄ₘ '26
Texas: Stephan F. Austin 30×35″ '31

GREAT LAKES SURVEY Charts since '45. 800 charts in 34 - U.S.C. + Geodetic Survey since '78
COAST SURVEY War Dept. since '41.
HYDROGR. OFFICE (Navy) near 3000 charts. Pilot charts since '83

STATES

PRIVATE CARTOGRAPHY

1750

James Turner d.1759 *engraver of many maps. Map of N.J. '47 Nova Scotia suppl to Evans 1759*
JOHN MITCHELL *British & French Dominions in N.Am 76×52" 1755. London (Used at Peace of Paris, 1783)*
LEWIS EVANS: *Middle British Colonies. Phila. '55 26×29" printed by Ben. Franklin. engr. James Turner.* 24 editions.

EARLIEST BRITISH & FRENCH MAPMAKERS' ATLASES

J. Palairet: *Atlas methodique 1775. London. Kitchin.*

60

John Rocque d.'62 *Plans of forts in America '63*

70

Th. Jeffery's AMERICAN ATLAS '75 maps 6½"×, publ. after Jeffery's death by Sayer + Bennet
" N.American Pilot '76 } surveys of Holland, J.Fisher, Ross, Gascoine, Gist, Mouzon, etc.
Le Rouge: *Atlas d'Amerique Septentrional '78. maps 5"×, contains Mitchell map*
Wm. Faden: *N. Am. Atlas '77. BATTLES OF AMER. REVOLUTION publ. in Atlas '96 London*

80

EARLIEST MAPMAKERS

Amos Doolittle *1754-1832 New Haven. Fine map of U.S. '84. map of Conn '88*
John Fitch: *Northwest U.S. (Ohio, Mich.) engraved by himself '85*
Christ. Collet: *Road map of U.S. 1¾"× in 86 small sheets '89.*
Benjamin Tanner *engraver. State maps, U.S. map etc.*
Samuel LEWIS *maps of states. U.S. '95, Atlas, with Arrowsmith (London) since 1804*
Delamarche *map '85, Paris showing Jeffersonian states*
J. Filson: *Kentucke, 1783*

90

EARLIEST U.S. ATLASES

Matthew Carey *1760-1839. General All.+ Amer Atlas since '94 Phila. maps by Sam Lewis, Doolittle etc.*
J. Scott: *U.S. Gazetteer '19 maps Phila '95*
J. Reid: *Elegant Atlas, New York '96 maps by B. Tanner etc*
J. Norman: *The American Pilot, Charts of Atlantic Coast '92 4"×*
Z. Cramer: *The Navigator (Ohio + Miss R.) Pittsburgh, 1801*

1800

SOUTH-WEST COAST

John Maclure *Geological map of U.S. 1809*
Humboldt: *Atlas de Nouvelle Espagne, showing California etc*
Juan Pedro Walker: *Pacific coast with legendary rivers '10*
David Thompson, *surveyor of the NW. Fur Co. Oregon, 1:500000*
J. H. Robinson: *N.C. S.C., La+Gulf Coast 66×90, 40"× '19*

EARLY MAP PUBLISHERS

John MELISH 1771-22. *Atlas '13. (Tanner) Phila.*
Jedidiah Morse: *Am. Gazetteer, Boston '97*
Sydney E. " : *Modern Atlas '22*
Cummings + Hilliard *Boston, school maps*
Lucas Fielding, *Baltimore, Atlas '22*
Carey & Lea. *Phila. Atlases '22 on*
H.S. Tanner " " '23 on
J. Conrad " " 24' "
Anthony Finley " " '24 "
John Farmer, *Detroit, Territories '30*
W. Ch. Woodbridge, *Hartford, Atlases since '21*
David H. BURR. *New York* " " '29
Th. G. Bradford, *Boston + N.Y.* " " '35

10 20 30

HENRY S. TANNER 1786-1858 NEW AMER. ATLAS '23
(brother of Benjamin) maps, atlases, guidebooks Phila.
LITHOGRAPHY *maps by Wm. Pendleton, Boston '27*

Capt. Seeward. Porter: *Charts of the Main Coast, 10 sheets 1:4 m. '37*

40

WAX ENGRAVING Sydney Edward Morse: *Cerographic Atlas '41 - N. American Atlas '42*
Disturnells *maps of Mexico (after Tanner) '47 (Used at Peace of Guadelupe-Hidalgo 48)*
SAMUEL AUGUSTUS MITCHELL 1797-1868 *Phila. Atlases '47-'93 yearly. maps. school atlases*

1850

COLTON family: J H. 1800-93. G.W. 27-1901, C.B. '32-'16. *Atlases 35-83 yearly*
Amer. Geographical Society *founded '32, incorp. '54*

COUNTY (city + state) ATLASES *usually ½"×, showing properties, lots, buildings etc. based on local surveys + Land Off. maps*

New York: Wm. Stewart 50-ies, E.W. Beers.
Philadelphia: G.M. Hopkins, H.B. Walker, D.G. Beers, G.W. + W.S. Bromley, Edwards brot.
Boston: G.H. Walker.
Chicago: G.A. OGLE, C.E. Warner, Anderson Co, J.H.N. Baers.
Detroit: Silas Farmer (son of John)
Minneapolis: A.T. Andrews, Ch. M. Foote

60 70 80 90

R.J. Johnson: *Family Atlas N.Y. '62 on*

H.F. WALLING '25-88. { *over 20 State atlases*
survey of Mass. '34-'88

Asher + Adams, Elisha Robinson.

Wm. H. Rand & Andrew Mc NALLY. *Chicago. Atlases since '76 yearly*
Geo. F. Cram. *Chicago, maps, atlases, Railway guides*
G.W. Gray *A.Phila. Atlases of Ohio, Md, Pa, - U.S. - World etc.*
G.H. Walker, *Boston, Atlas of Mass. '91*
Justin Winsor, *Harvard Univ. Studies in early Amer. cartogr.*
National Geog. Society *founded '88*

1900

COMMERCIAL MAPS *cheap, wax-engraved maps*

Rand McNally: *Chicago*
A.J. Nystrom " "
Denoyer-Geppert " "
C.S. Hammond, *New York.*
FIRE INSURANCE MAPS - *Sanborn Co, Pelham N.Y.*
AUTO ROAD MAPS

10 20 30

PHOTOENGRAVING & COLORPRINTING

JULIUS BIEN 1826-1909 *lithography* — J. R. Bien: *Atlases of N.Y. Pa. etc.*
Hoehn Co *in Baltimore*

SCIENTIFIC ASPECT IN CARTOGRAPHY

Wm. Morris Davis, *Block diagrams,*
Van der Grinten *projection 1905*
E.E. Howells, *New York + Wash* } *high grade topogr. models*
G.G. Curtis, *Boston*
Paul GOODE, *Chicago. Interrupted projections '16. - Schoolmaps*
D.W. Johnson. *Battlefields of the World War, block diagrams by* { A.K. Lobeck, F.K. Morris, S.H. Knight
A.K. Lobeck *Physiographic map of U.S '21, Europe '23.*
Hispanic America 1:1000000 *publ. Am. Geog. Soc. since '22.*
Relief modell of U.S. 4"× 63×46 *feet, Babson Inst. Wellesley Hills, Mass.*
Guy Harold Smith *physiographic maps, Japan '34, South Am. '35*
A.H. Bumstead: *cartogr. Natl Geog Soc Europe '29 - Asia '33 - Central Am. '34*
H.O. Paullin & J.K. Wright: *Atlas of the Historical Geog. of U.S. '32*

AIRPLANE SURVEYS Fairchild Co. in New York
Massachusetts 1:20000 & 1:30000 *Inst. of Geog Exploration, Harvard U. '33*

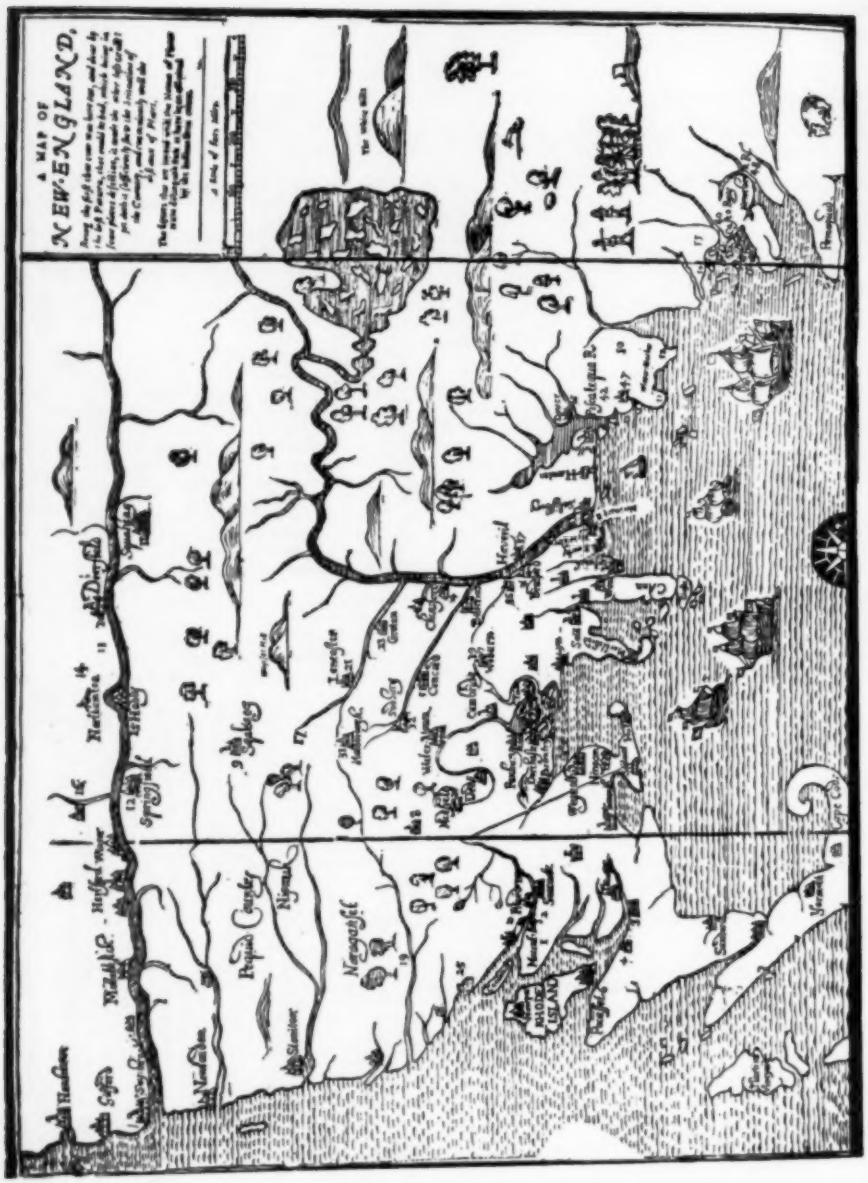

FIG. 1. JOHN FOSTER's map of New England. The first map engraved and published in the American Colonies. Woodcut. Boston, 1677.

drawn with charming naivete, but even in its crudeness it must have represented, in its time, a brave attempt in the finer arts amidst the harsh life of the early colonists.

The first copper-engraved colonial map dates from 1688, (JOHN REID, *A Mapp of the Rariton River*), and from this time on, few colonial maps were published for nearly a century. Among these the most famous is the BONNER-PRICE map of the City of Boston (1722), which in its seven new editions up to 1769, — each brought up to date, — gives an unparalleled opportunity for studying the development of a colonial city.

The highest development of colonial cartography was reached in the middle of the 18th century. The most important map of this period is the EVANS map of The Middle British Colonies (1755). Three great names are connected with this map. The author, LEWIS EVANS, compiled a map which is remarkable for its accuracy and wealth of information. In the accompanying *Analysis* he states his sources of compilation — maps, journals, and narratives of Indian traders. The map, he states, was prematurely issued on account of the impending French war. Some of his statements in the *Analysis* involved him in a dispute with the Governor of Pennsylvania, and EVANS died in prison. The influence of the EVANS map was very great.

Twenty-six subsequent editions, some of them piratical, were collected by the Library of Congress. The map was cut in copper by JAMES TURNER, one of the greatest engravers of his time. In cartographic art the map is equal to the best works produced in Europe. TURNER engraved several maps, and he is the author of a map of Nova Scotia, a supplement to the EVANS map. The EVANS map was printed by the press of BENJAMIN FRANKLIN, whose contribution to cartography is a famous chart showing the Gulf Stream.

Equal in importance to the EVANS map is the contemporaneous map of JOHN MITCHELL of the *British and French Dominions in North America*, 1755. This is a very large map with remarkable detail, but it was produced in London. This map was used by the Peace Conference of Paris in 1782, and on it were outlined the boundaries of the new republic. At least eighteen editions were printed on the original scale prior to 1792 in England, France, Holland, and Italy.

FIG. 1. JOHN FOSTER'S map of New England. The first map engraved and published in the American Colonies. Woodcut. Boston, 1677.

During the quarter century preceding the Revolution, intense surveying was done by the British Army and Navy. WASHINGTON himself made many land surveys throughout his life. We should not imagine these army surveys to be very accurate. They had no framework of triangulation, and the instruments used were the chain, compass, plane table, and sometimes a diopter and a perambulator (odometer). A keen sense of distance was the most important asset for these early surveyors in the densely wooded Appalachian Mountains.

Most of these surveys remained in manuscript or were published in London, notably in JEFFERY's atlases. A superb collection of these early army maps is in the Clements Library at Ann Arbor, Michigan. These surveys laid the foundations of the future American maps, and many of the Army surveyors later became leading figures in American cartography, as THOMAS HUTCHINS, SIMEON DEWITT, JOHN HILL, and others.

2. EMANCIPATION OF AMERICAN CARTOGRAPHY (1780-1820)

With the establishment of the new republic began the slow emancipation of American cartography from European influence. WASHINGTON, himself a surveyor, and JEFFERSON, son of the author of the FRY-JEFFERSON map of Virginia, were both keenly interested in cartography. THOMAS JEFFERSON's own map (*A Map of the Country between Albemarle Sound and Lake Erie*, 1787), although published in Europe, represents a major piece of American map compilation. THOMAS HUTCHINS, the first and only "Geographer to the United States", organized the survey of the enormous tracts of public lands. He adopted the traditional 36 square mile township and section system, which is still prevailing over the greater part of the United States. The General Land Office became one of the most active mapping agencies of the government. ABRAHAM BRADLEY's large map of the Post Roads of the United States, published in 1796 and reissued every few years, replaced the MITCHELL and EVANS maps as the "mother map" of the United States.

The most important mapping activities of this age were the

organized state surveys. State after state appropriated a rather modest looking sum, ranging somewhere between $50,000 and $300,000, for the preparation of a state map, with scales varying from 2 to 8 miles per inch. None of these surveys was based on triangulation (up to 1830, Massachusetts), and the maps were based perhaps more on compilation than on instrumental surveys. Yet the THOMAS GORDON map of New Jersey, the DENNIS GRIFFITH map of Maryland, the WARNER GILLETT map of Connecticut, and later the BURR Atlas of New York are real cartographic achievements. The western states and territories were mapped by the General Land Office with remarkable speed, but less remarkable accuracy, under the pressure of the immediate demand for layouts and maps by the settlers.

The beginning of private cartography was very modest. First came a few very original products as JOHN FITCH, the inventor of the steamboat, made a rough but significant map of then *Northwest United States* which he engraved himself. AMOS DOOLITTLE, distinguished engraver and silversmith of New Haven, prepared together with ABEL BUELL a map of the United States (1789). This is said to be the first map of the United States drawn, engraved, printed, and published by its citizens. The first atlas made in the United States is a set of charts of the Atlantic Coast, *The American Pilot*, compiled and cut in copper by the noted engraver JOHN NORMAN, and published in 1792.

Then a few book publishers decided to add atlases to their line, the first being MATTHEW CAREY in Philadelphia (1794). His atlas was republished almost every year, and from 1822 on the work was continued by his son H. C. CAREY (CAREY & LEA). These early atlases were small in form and the plates for the maps of the foreign countries were imported or copied from European maps. More original were the state maps, which were chiefly the work of such excellent engravers and map compilators as SAMUEL LEWIS, BENJAMIN TANNER, and AMOS DOOLITTLE. The clean cut and very delicate lines and selective use of decorative detail recall the charm and dignity of contemporary art and architecture.

It soon became evident that these American atlases could compete with the European products, and the field was open for lucrative business. JOHN MELISH employed more than thirty

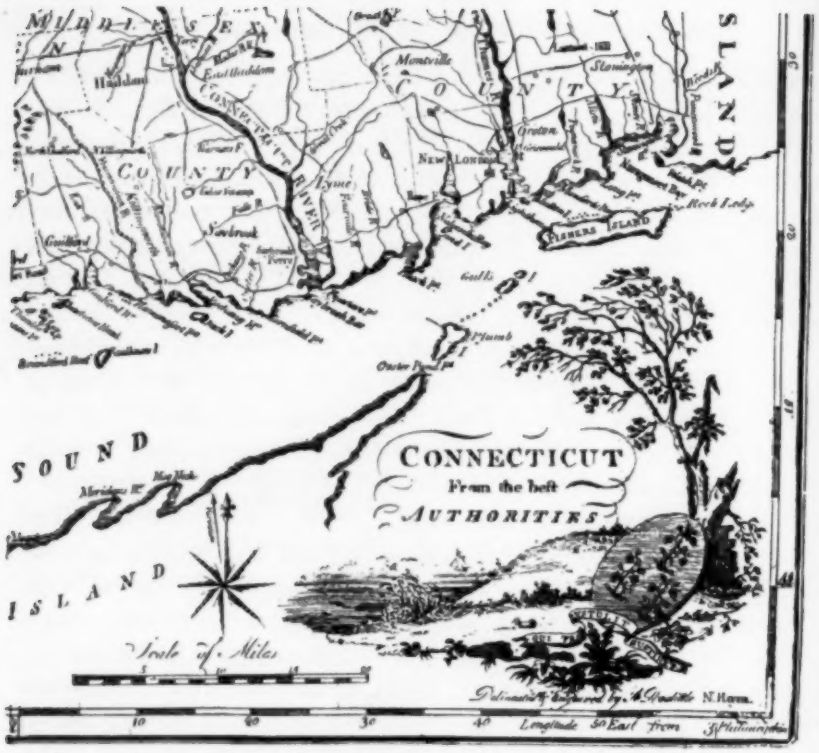

FIG. 2 Part of a page from MATTHEW CAREY'S *American Atlas* 1794. This is one of the first atlases published in America.

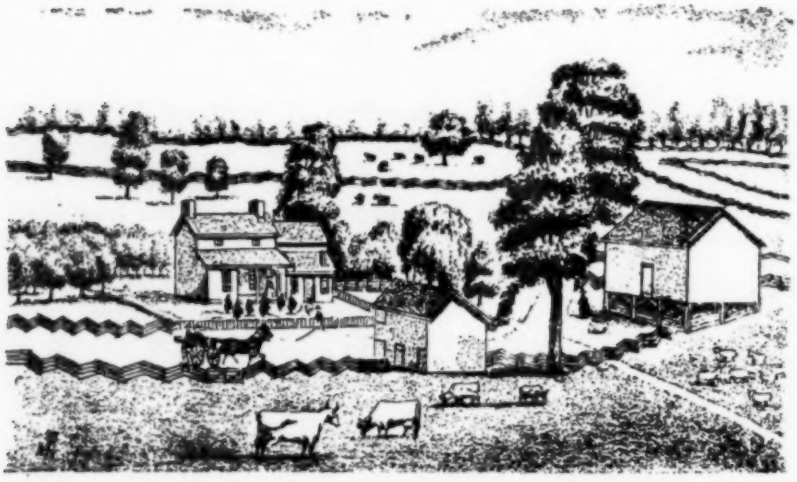

FIG. 3. Typical lithograph from a county atlas.

mapmakers in his office in Philadelphia in 1810, among them the TANNER brothers.

Many geography books and school atlases were published at this time. Especially famous was the geography of JEDIDIAH MORSE, a minister of Charlestown in Massachusetts, which was accompanied by an atlas by ARROWSMITH and SAMUEL LEWIS. Boston remained for a long time the publishing center for school atlases.

3. THE GOLDEN AGE OF AMERICAN CARTOGRAPHY (1820-1840)

In the second quarter of the last century the young nation emancipated itself, not only politically, but spiritually also, from the Old World, and the westward expansion was in its full swing. Enterprising spirit ran high in all fields, and so in cartography. The demand for maps was great. The frontier of the country advanced year by year; roads, canals, and railroads were built, and maps were a prime necessity. The surveys of the General Land Office, of the states, and of the Army and Navy were hardly able to keep up with the rapid changes, and private cartography had to come to their aid. The maps and atlases of this period are representing the best in the history of American cartography.

Philadelphia remained the cartographic center during this age, but New York, Boston, Baltimore, and Hartford were important producers of maps, too. During the two years from 1822 to 1824, not less than seven large atlases were published in the United States, and some of them were republished every few years. The maps and atlases of this age represent a great refinement in the art of copper and steel engraving. The lines are incredibly delicate, the lettering is tiny, but very perfect. There is no pictorial detail inside the map, pictures and decorations are concentrated into vignettes around the map or within the little cartouche. The title is usually framed with a trellis of interlocking swash lines, a very characteristic feature of this period. Mountains are represented by fine hachure lines. No important map or atlas was published without an extensive text of geographic data, and many maps were surrounded by quaint pictures of cities and

scenery. In most cases the text was cut into copper at the same time as the map, but CAREY and LEA in Philadelphia (successors to MATTHEW CAREY) developed a method by which the map was printed first, and the text set up in type around it, and this method was widely imitated. The maps were generally expensive, because the copper plates required heavy rag paper; but on the other hand, their chance of survival was much better than that of the maps of later ages.

The foremost cartographer of this age was HENRY SCHENCK TANNER (1786-1858), brother of BENJAMIN, the famous engraver. His *New American Atlas*, first published in 1823, is a landmark in American cartography. He collected all available state and government maps, reduced them to uniform scale and form, added much of his own wide experience, and produced a work which was equal to the best European atlases of his age. Added to this atlas are his geographic *Memoirs*, which summarize all exploratory, surveying, and cartographic work done in this country, — our only available information of this sort. HENRY was later joined by his brother BENJAMIN, and the TANNER office in Philadelphia became one of the most prolific producers of maps, atlases, and guide books.

The most notable army explorations of this period were those of ALLEN, SCHOOLCRAFT, and later NICOLLET in the Upper Mississippi region. BONNEVILLE in 1837-1857 mapped the Great Basin, the topography of which was remarkably misunderstood at that time. JUAN PEDRO WALKER produced a map in 1810 in which he placed three enormous rivers arising from the Colorado Rockies, and reaching the Pacific coast at various parts of California. LEWIS and CLARK have shown in their map an overlengthened Willamette River (called Multonomah River) arising also in the present Colorado. These rivers were accepted by TANNER and put in his atlas, with a remark, however, as to their doubtful validity. Other mapmakers copied these rivers, but the note to their uncertainty was often left out, and the four legendary rivers of the West did not disappear from the maps until 1838.

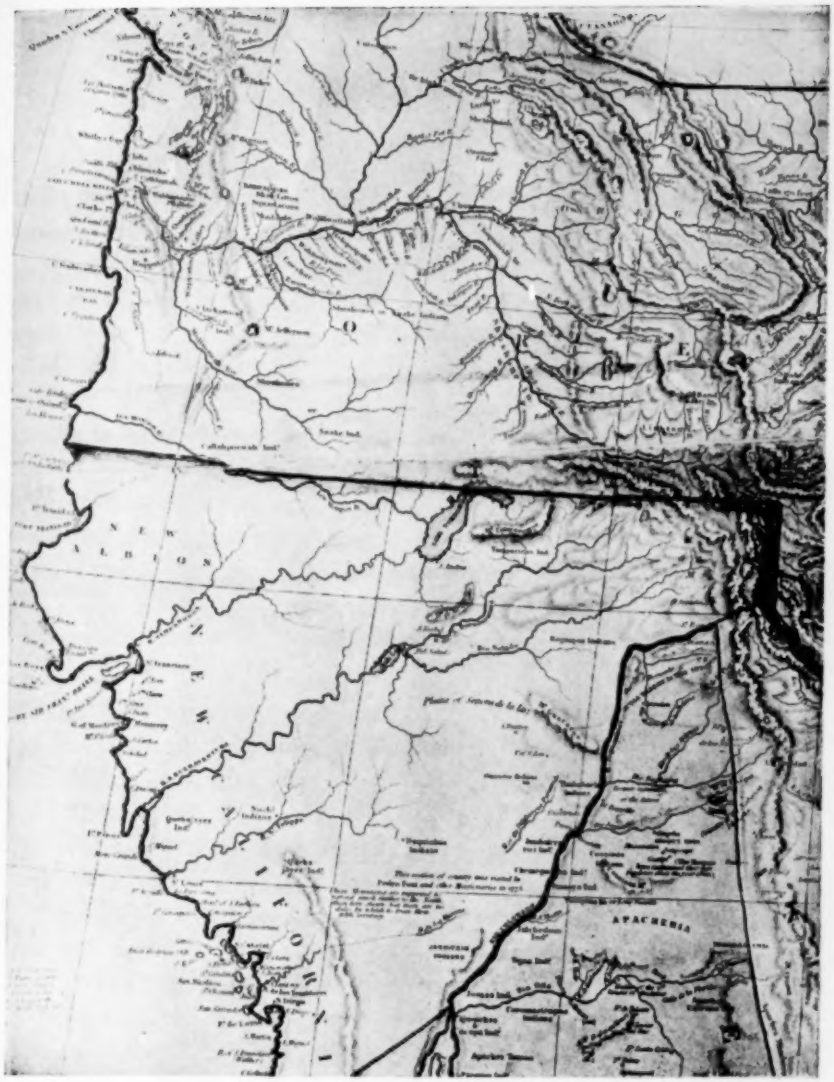

FIG. 4. Legendary rivers of the West, from HENRY S. TANNER's *New American Atlas* 1823.

4. LITHOGRAPHY AND WAX ENGRAVING (1804-1860)

In the middle of the last century the invention of new methods of reproduction changed the entire aspect of cartography. Lithography was invented in 1798 in Germany, where it became the general method of map reproduction. In the United States it was first used for maps probably by WILLIAM PENDLETON in Boston in 1827. The principle of lithography is that the map is drawn reversed as in a mirror, with a greasy ink upon lithographic stone. The stone has the quality of taking either ink or water, and if the stone is rolled over with printing ink, the ink will adhere only to the lines. The advantage of this method is that it does away with the laborious engraving into copper, and that the map can be printed on ordinary cheap paper. The lines are delicate enough, but not so clean cut as on the copper engraved maps. Lithography became a popular method of reproducing maps in the middle of the century.

Wax engraving was invented by SIDNEY EDWARD B. MORSE, son of JEDIDIAH MORSE, and brother of SAMUEL FINLEY MORSE, the painter and inventor. He worked out the system of wax engraving together with HENRY H. MUNSON, and his first "Cerographic Atlas" was published in 1841. In wax engraving the map is engraved into a thin sheet of wax, which is spread over a polished plate. The wax, with the grooves in it, is then electroplated. After the removal of the wax the electroplate is strengthened and mounted. Printing is done directly from the electroplate, which will print from raised lines, as ordinary type does. The advantage of this method is that the map is engraved into wax straight and not in a mirror-like fashion, and also that the plate can be printed together with text. The chief advantage, however, is that the lettering can be set up in type and pressed into the wax. Mechanical tints can also be easily applied by combing the wax surface. Wax engraving made but little progress at first, but at the end of the century it became very popular, and is still much used.

The use of electroplated copies was extended to the steel and

copper engraved maps, too. Instead of printing from the copper plates themselves, by which the copper was worn out by the first few thousand imprints, the printing from "electros" allows for an infinite number of copies. The extremely fine first charts of the United States Coast Survey of 1845 were thus engraved in copper, and printed from electros.

The result of all these inventions was twofold. First of all they made maps cheap, and thus available to everybody. On the other hand, what was gained in quantity was lost in quality. Especially the wax engraved maps looked very mechanical, and the ease by which lettering could be stamped in encouraged overlettering, which is still a characteristic of the American map.

The most outstanding cartographer of this period was SAMUEL

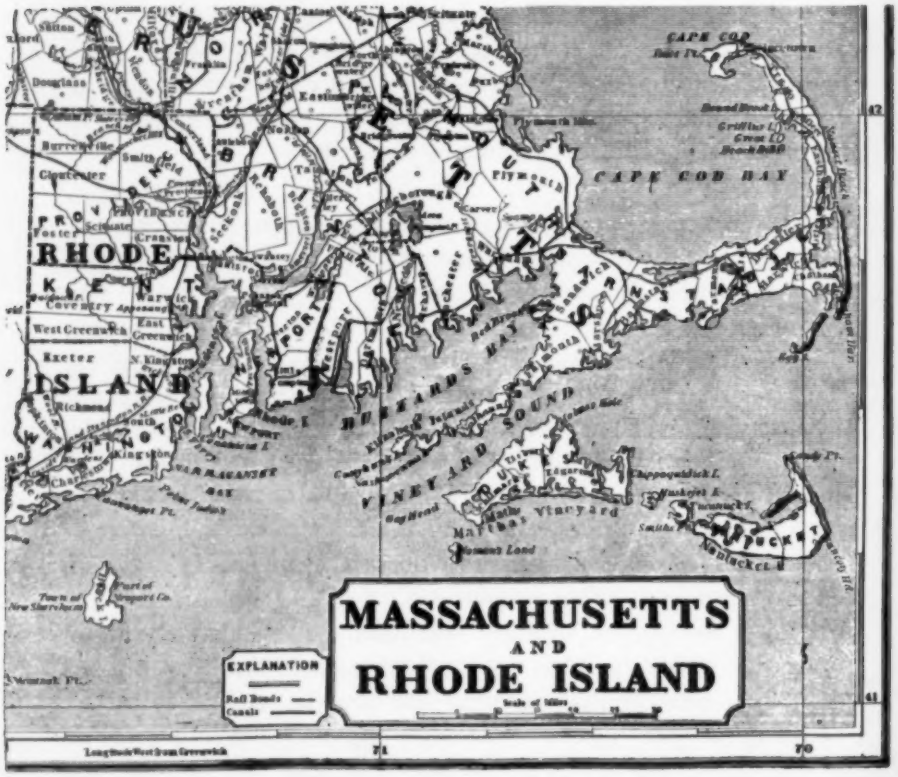

FIG. 5. Part of a page from SYDNEY E. MORSE's *Cerographic Atlas* 1841. This is the first atlas reproduced by wax engraving; showing tendency for overlettering.

AUGUSTUS MITCHELL (1797-1868) in Philadelphia. He was a disciple of the TANNERS, and took over the TANNER establishment in the middle of the century. The MITCHELL Atlas, published yearly from 1847 to 1893, was a characteristic product of American culture of the Victorian period.

The most prolific producer of maps at this time was the COLTON family in New York. The COLTON Atlas was published from 1855 to 1883 yearly, with an excellent and extensive geographical text. Characteristic of the COLTON maps is a very ornamental border consisting of interlacing vines. The COLTON establishment, 172 William St, New York, printed, besides a variety of maps, gazetteers, and atlases of the United States, many South American maps, too, in competition with the cartographic establishments of Paris.

Among the government offices, the Army was the most important producer of maps. The most important Army survey was that of FREMONT, whose excellent map of the new West (1848) was drawn by CHARLES PREUSS, and appeared just in time for the California gold rush.

5 COUNTY ATLASES (1860-1900)

With the spreading of lithography, the most specially American cartographic products, the county atlases, began their development. They were probably first made by WILLIAM STEWART in New York in the '50's, and were imitated by most mapmakers of Philadelphia, New York, and later of Chicago, and in the '70's and '80's attained the significance of a national industry. They were still published at the beginning of the 20th century, but at that time, with the growing industrialization and urbanization of the country, they lost their significance.

The typical county atlas remained very much the same during the half century of its history. It shows detailed township and property maps, mostly 2 inches to the mile, based upon the Land Office surveys, and contains also much original material collected by the agents of the publishing company. Besides the maps there is extensive text material, profusely illustrated with pictures

of farms and factories in the quaint style of old lithographs. They were generally sold by subscription, and of course every farmer was glad to part from ten or twenty dollars if he knew that a picture of his farm or of himself would win him countywide distinction, even if this distincion would be shared with many others. Although these county atlases were made purely from a business point of view, they contain much original material, and form a valuable aid in historical research. In the '90's, when photo-engraving came into fashion, the quaint lithographs were replaced by halftone copies of photographs, losing the artistic touch of the earlier drawings. The most prolific publisher of county maps was G. A. OGLE in Chicago, who has more than 700 county atlases to his credit.

The most important cartographer of this age was HENRY F. WALLING (1825-1888), professor of engineering in Lafayette College, who prepared over twenty state atlases with extensive texts. His maps and atlases have the distinction of thorough research, enormous amount of detail, and perhaps a little more artistic appearance than the rather drab maps of this period.

6. THE AGE OF THE GREAT SURVEYS (1870-1900)

In the middle of the last century the United States acquired enormous tracts of land west of the Rocky Mountains. To survey these territories, the U. S. Army sent out party after party, which did notable work in spite of the hardships and danger from Indian attacks. The early surveys of G. K. WARREN, Lieutenant IVES, and Captain REYNOLDS were interrupted by the Civil War. The Civil War itself disclosed how inadequately the country was surveyed, and after the war was over, surveying activity was renewed with new vigor. The four great Western surveys known as the KING, WHEELER, POWELL, and HAYDEN Surveys covered hundreds of thousands of square miles, but it was soon found that these individual efforts resulted in so much duplication that a nationally organized survey was necessary. In 1878 the United States Geological Survey came into existence, which is the chief mapping agency of the United States today.

From the cartographic point of view, the atlases of the early surveys are remarkable achievements. The field parties were accompanied by first class artists, among them WILLIAM H. HOLMES, whose set of views of the Grand Canyon is a classic of topographic art. Most of these atlases were engraved by JULIUS BIEN, New York. He represented relief by plastic shading, whch was made possible by the perfection of halftone lithography. It is somewhat to regret that the U. S. G. S. adapted the purely contour line method of the New Jersey state maps for its topographic sheets, without combining the contour lines with plastic shading and merged altitude tints, which were so masterfully handled by JULIUS BIEN.

In the '80's and the '90's not only the U. S. G. S., but other government agencies such as the Coast and Geodetic Survey, the Hydrographic Office, and the Army Engineers, produced an enormous amount of maps, and put them on the market cheaply, eclipsing private cartography. In the United States, more than in any European country, do we look for maps to be produced by the government instead of private enterprise. The maps of the U. S. G. S., especially the three-colored topographic sheets, became standards for American maps. Their method of engraving is extremely complex; it combines all three major methods, lithography, wax engraving, and copper engraving, in order to produce lines as fine and clean cut as possible.

It would be hard to name the foremost cartographers of the age of the Great Surveys. The production of maps became an extremely involved process, requiring the cooperation of so many men that the individual can hardly be distinguished. Perhaps the most outstanding works are those of F. E. MATTHES, whose maps of the Grand Canyon and the Yosemite Valley are highly praised.

7. MODERN MAPS
(1900-1930)

The modern age in American cartography is characterized by a more scientific trend, and also the enormously widespread application of maps, not only in the scientific field, but also in the everyday life of people. This was largely made possible by the

introduction of photo-engraving. By this method the map need not be engraved in copper or put on stone by highly skilled craftsmen, but can be drawn on paper on an enlarged scale by anybody with some knowledge of drawing, and photographic reduction will produce a fine looking map. The importance of this is perhaps greater than it seems at first glance. Maps can now be made by geographers and not necessarily by highly skilled engravers. The resulting maps may be less perfect technically, but they will more informally express geographic ideas. Photo-engraved maps can be printed together with text. Not only are all our textbooks prolifically endowed with maps, but even newspapers use maps nowadays to illustrate daily events. The perfection of color printing enables cartographers to represent the most complex geographic concepts. Modern geological and soil maps, the maps used in economics, meteorology, and other sciences, require often a dozen successive printings and the use of mechanical tints.

The American Geographical Society was founded in 1852, and since that time it has produced maps of high excellence in its publications. Its most outstanding work is the 1 : 1000000 series of Hispanic America, a part of the International Map of the World, the greatest cartographic undertaking of modern times. The National Geographic Society in Washington is also a prolific producer of maps, which reflect the genius of A. H. BUMSTEAD, who has a special ability to give the greatest amount of information with the minimum of overcrowding.

There is a closer connection between geology and cartography in the United States than elsewhere, perhaps due to the organization of the U. S. G. S., where many cartographers received their training. A result of this connection is a specially American product, the physiographic map. In this method, instead of emphasizing the altitude of the land, its geomorphologic aspect is delineated, giving on small scale maps a better representation of the geographic landscape than the other methods. This method originated with W. M. DAVIS, and was further perfected by A. K. LOBECK, and is now recognized also overseas.

Notable work has been done during this period in topographic models. E. E. HOWELL was a distinguished and prolific producer of excellent models, always emphasizing the geological structure

of the land. Equally excellent are the models of C. C. CURTIS of Wiscasset, Maine, whose models of the Boston region and the Kilauea in Hawaii are now the prize exhibits of the University Museum at Harvard. He started the huge relief model of the United States at the Babson Institute, Wellesley Hills, Massachusetts, which, when ready, will show the United States 63×46 feet in size on a scale of 4 miles to the inch.

How deeply cartography has entered the life of the great masses is shown by the present auto road map. These maps, given away freely by any filling station and printed in millions of copies, assume the scope of a national industry. They are much derided, yet the amount and exactness of their information and their practical delineation can best be appreciated by those who have used similar products in Europe, bought at an excessive price.

8. AIRPLANE PHOTOGRAPHY
(1930-)

In the latest years cartography received a new stimulus by the introduction of airplane photography. Surveys which took years to accomplish can now be conveniently made with an airplane in a few hours, and at a fraction of the past costs. For instance, the airplane survey of the entire state of Massachusetts, which was made by the Institute of Geographical Exploration in 1933, covered the entire state in 24 flying hours. The photographs so obtained are rich in detail, but have to be transformed to give geodetic accuracy. An entirely new airplane survey of the United States is planned now by the government. The present conventions used on maps are not adapted to reproduce the type of detail which the photographs furnish so abundantly. To produce a new type of map, which is able to utilize fully the airplane surveys, seems to be a major task of cartography at the present time.

(Harvard University) ERWIN RAISZ.

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The theory of the diurnal rotation of the earth

In the *Experimenta Nova* of 1672, the German scientist OTTO VON GUERICKE describes in some detail the four astronomical conceptions active in his day. These are, he says, the Ptolemaic, the Copernican, the Tychonic, and what he terms "De Systemate alio," or that of the diurnal rotation of the earth. (1) The first three of these interpretations have received more or less adequate historical treatment, with the result that their continuity, persistence, and influence are comparatively well known. (2) Unfortunately, this is not the case with the theory of diurnal rotation, the oldest and not the least important of the four.

This incomplete and merely suggestive review of the continuity and influence of the hypothesis before NEWTON and the *Principia*, properly begins with the early Greeks, among whom the belief was both prevalent and important. On the authority of EUDEMUS, THEON OF SMYRNA (3) and ANATOLIUS (4) attribute it to ANAXIMANDER. (5) Quoting THEOPHRASTUS, CICERO describes HICETAS

(1) The Ptolemaic hypothesis is described in chapter IV; the Copernican, in V-VIII; the Tychonic, in IX, and De Systemate alio, in X. VON GUERICKE describes the last (pp. 19-20) as the " quartum Systema Mundi, cujus primi Authores HERACLIDES PONTICUS, item ECPHANTUS, & PLATO dum juvenis esset, quos postea secuti sunt ORIGANUS, LONGOMONTANUS, ac nuperrime M. MICHAEL HAVEMANNUS Ministerii Stadensis senior, in *Astraea sive Siderali Scientia*, & alii." GUERICKE supports the revised Copernican system of his day.

(2) The historical treatment of the geo-heliocentric conception, of which the Tychonic system is one variation, is on the whole less adequate. It has been skillfully carried through the Middle Ages by DUHEM, and its vogue in the 16th and 17th Centuries discussed, among others, by DELAMBRE and RICCIOLI, but no history devoted to the theory seems to exist.

(3) *Philosophi Platonici*, recensuit EDUARDUS HILLER, Lipsiae, 1878, p. 198.

(4) *Bibliotheca Graeca*, ed. FABRICIUS (4th ed.), Hambvrgi, 1788, III, 464.

(5) Although the attribution by ANATOLIUS apparently has not been discussed, that by THEON has received marked attention. DIELS includes it in his EUDEMUS-ANAXIMANDER fragments, but TANNERY and HEATH reject and omit it. The major criticisms appear to be that THEON is not quoting EUDEMUS but DERKYLLIDES

of Syracuse as an advocate of the conception, and Diogenes Laertius presents it as the theory of Leucippus. (6) The Pseudo-Plutarch, (7) Eusebius, (8) and Hippolytus (9) join in adding Ecphantus of Syracuse as a third member of this group of Fifth Century adherents. According to Aristotle, (10) Diogenes

(Tannery, *Mémoires Scientifiques*, I, 169), that κινεῖται, "moves," is an error for κεῖται, "lies" (Montucla, *Histoire des Mathématiques*, I, 107, and others following him), and, that since the cosmos of Anaximander is geocentric, the earth could not move around the center of the universe, and the statement is a misapprehension of what Anaximander said as to the suspension of the earth (Heath, *Aristarchus of Samos*, pp. 24-25; Zeller, *Philosophie der Griechen*, I, i, 303n.). For the reason that the purpose of this review is not primarily to show who advocated the theory, but that the theory was well-known and important, it is unnecessary to take serious issue with the distinguished authorities who consider the ascription as an error. However, in fairness to the challenged account of Theon, and the apparently unchallenged one of Anatolius, it should be mentioned with regard to the first criticism, that transmission through Derkyllides, if proved, is not of itself evidence of error, and that, as is indicated by the passages preserved in the *Fragmenta Philosophorum Graecorum* (III, 276 ff.), a theme common to the history of Eudemus is: "Who first discovered various scientific conceptions," which theme is faithfully followed by both Theon and Anatolius, with the account of the latter bearing the caption, "Who Found What in Mathematics." The objection that κινεῖται, "moves," is an error for κεῖται, "lies," and that the statement should be κεῖται περὶ τὸ τοῦ κόσμου μέσον, "lies around the center of the universe," has apparently failed to consider that the preservation of syntax suggests that κεῖται would be followed by ἐν τῷ τοῦ κόσμου μέσῳ, a reconstruction involving not one word but four. The third objection is more apparent than real, for in Greek geocentric thought it is not the earth, but the center or axis of the earth which is regarded as the center or axis of the universe, a conception definitely stated by Aristotle and Diogenes Laertius in attributing belief in diurnal rotation to Plato. "About the axis of the whole heaven," is Aristotle's description, and that of Diogenes Laertius, "And being at the center, it moves about the center." The statements by Theon and Anatolius follow the manner of Eudemus, are presented without variation in all manuscripts, and are in harmony with other descriptions of the axial rotation of the earth. Theon and Anatolius may be mistaken in the fact, and should be received with question, but it appears certain, so far as certainty is possible in doxographic passages, that they said, "Anaximander was the first to state that the earth hangs in space and moves around the center of the universe." To reject and omit such statements is at best unfortunate in a field where references are so limited and so uncertain.

(6) Cicero, *Academica*, II, xxxix Diogenes Laertius, *Lives*, IX, vi (Hicks Tr., II, 441).

(7) *Doxographi Graeci*, ed. Hermann Diels (Plutarch's *Epit. III*, 13 [Aëtii *Plac.* III, 13]), 1929, p. 378.

(8) *Evangelica Praeparatio*, Oxford, 1903, III, ii, 914.

(9) *Refutation of all Heresies*, London, 1921, I, 50.

(10) *De Caelo*, Oxford, 1922, II, 13, 2.

LAERTIUS, (11) and "some people," the belief was held by no less a personage than PLATO, the last of these statements occurring in that passage where CICERO discusses HICETAS : (12)

> The Syracusian HICETAS, as THEOPHRASTUS asserts, holds the view that the heaven, sun, moon, and in short all of the things on high are stationary, and nothing in the world is in motion except the earth, which by revolving and twisting round its axis with extreme velocity, produces all the same results as would be produced if the earth were stationary and the heaven in motion; and this is also in some people's opinion the doctrine stated by PLATO in the *Timaeus*, but a little more obscurely (13).

These various doxographic passages, coming to us at least second, and often fourth or fifth hand, are scarcely dependable evidence with reference to the views of individuals They do indicate, however, that among the early Greeks the theory of diurnal rotation was well known and important, and, that ARISTOTLE's active and extended attack upon it was an attac upon a major astronomical hypothesis of his day. (14) The second portion of this interpretation has the support of the many accounts which describe HERACLIDES, his contemporary, as an advocate of the conception. (15) Among subsequent friends of the theory, according to PLUTARCH and SIMPLICIUS, we find ARISTARCHUS, (16) and according to AËTIUS and PLUTARCH, SELEUCUS. (17)

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(11) *Lives of Eminent Philosophers*, London, 1925 (Book III), I, 335.

(12) DIOGENES LAERTIUS states (*op. cit.*, II, 399) that " other authorities " ascribe to HICETAS the belief that the earth moves in a circle but his association in this passage with the Pythagorean PHILOLAUS suggests that the theory in question is not rotation but movement around the central fire.

(13) *Academica*, II, xxxix. This interpretation has been generally rejected.

(14) *De Caelo*, II, 13, 14.

(15) Sextus EMPIRICUS, *Adversos Mathematicos*, ch. IX; PSEUDO-PLUTARCH, *op. cit.*, p. 378; EUSEBIUS, *op. cit.*, III, 914; PROCLUS, *In Platonis Timaeum Commentaria* (ed. DIEHL, III, 138) 281E; SIMPLICIUS, on *De Caelo*, II, vii, xiii, xiv. HEATH cites a further reference, *Schol. in Aris.* (BRANDIS) p. 505 b 46-7 : " HERACLIDES OF PONTUS supposed that the earth moves about the centre, while the heaven is at rest, and thought in this way to save the phenomena."

(16) *Platonic Questions*, VIII; On *De Caelo*, II, vii.

(17) AËTIUS (PLUTARCHI *Epit.*, III, 17; STOBAEI *Ecl.*, I, 38) *Doxographi Graeci*, p. 383; *Platonic Questions*, VIII. In this reference, PLUTARCH is interpreted by HEATH (*op .cit.*, pp. 305-306) and others as attributing to ARISTARCHUS and SELEUCUS the hypothesis of the " double motion " of the earth. Although ascription to these men of the movement of diurnal rotation is definite, that of a second motion is open to serious question, as the complete passage indicates : " What means

Among later writers, exclusive of historians, (18) the hypothesis is discussed by SENECA and PTOLEMY. The latter, as might be imagined, opposes the conception, arguing that stones thrown upward perpendicularly would not return to the place of propulsion, and that birds attempting to fly would be left behind if moving with the rotation. (19) To SENECA, the problem is an important one which merits investigation :

> There have been persons who made bold to say that it is we that all unwittingly are borne round by the frame of things, that risings and settings are not produced by the movement of the heavens, but that we ourselves rise and set. The subject well deserves our study, if we are to know where we really stand, whether the abode we have obtained as ours is the most sluggish or the swiftest of motion, whether God [deus] causes all things to revolve around us or causes us to revolve (20)...

Following the classical commentators of the first and later eras

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TIMAEUS when he says that souls are dispersed into the earth, the moon, and other instruments of time? Does the earth move like the sun, moon, and five planets which for their motions he calls organs of time? And is the earth fixed to the axis of the universe, not so built as to remain immoveable, but to turn and wheel about? as ARISTARCHUS and SELEUCUS have shown since, ARISTARCHUS only supposing it, SELEUCUS positively asserting it. THEOPHRASTUS writes how PLATO, when he grew old, repented him that he had placed the earth in the middle of the universe, which was not its place."

In this passage we find a concluding statement preceded by three questions, to the last of which is subordinated the ascription, " as ARISTARCHUS and SELEUCUS "... The first question has no apparent connection with the views of these men. If the second describes movement in space, as it suggests, the second and the third conceptions are incompatible, and could scarcely be held by one person. Specifically, if PLUTARCH is ascribing both views to ARISTARCHUS and SELEUCUS, he is stating they believed, first, that the earth moved in space, and second, to follow HEAT's slightly different translation, that the earth " ' which is globed about the axis stretched from pole to pole through the whole universe ' was not represented as being held together and at rest, but as turning and revolving "... It is impossible to conceive of the earth as revolving *on the axis of the universe* (italics mine) and at the same time as moving in space. Being incompatible, the second and third queries, unless the passage is corrupt, are plainly independent, and the ascription to ARISTARCHUS and SELEUCUS belongs properly to the third question, to which PLUTARCH has attached it. The second question suggests the Pythagorean conception, the only one in which the earth could be in motion with the sun, the moon and the five planets. With this theory and that of diurnal rotation in balance, the opinion of THEOPHRASTUS is introduced in favor of the Pythagorean, according to which the center of the universe is not the place of the earth. PLUTARCH then questions this conclusion.

(18) For reconstructions of lost historians, see especially DIELS, *D. G.*

(19) *Almagest*, I, vi.

(20) *Questiones Naturales*, VII, 2, tr. JOHN CLARKE, pp. 273-274.

come the hostile Christian historians of the Third and Fourth Centuries. (21) From these we turn to the friendly ĀRYABHAṬA of the Fifth, who held with the Greeks before him that "the sphere of the stars is stationary, and the earth, making a revolution, produces the daily rising and setting of stars, and planets." This definite account is preserved in the early Seventh Century *Brāhamasphuṭa Siddhānta* of BRAHMAGUPTA, who rejects however the conception, asking, "If the earth move a minute in a prana, then whence and what route does it proceed? If it revolves, why do not lofty objects fall?" Following BRAHMAGUPTA, either the theory remains long dormant, or discussions of it are lost, for the next presentation of the hypothesis apparently belongs to the Twelfth Century, when, in the *Commentary on Brahmagupta* of PRIT'HUDACA SWAMI, the opinion held by ĀRYABHAṬA is judged "satisfactory," and "the objection, that lofty things would fall, is contradicted, for every way, the under part of the earth is also the upper, since wherever the spectator stands on the earth's surface, even that spot is the uppermost." (22)

After the Twelfth Century, references to the theory multiply, there being in the subsequent era at least six writers who discuss the hypothesis. Five among these, AL-SHĪRĀZI, ABŪ-L-FARAJ, AL-KĀTIBĪ, GIOVANNI CAMPANO DA NOVARA, and Saint THOMAS AQUINAS reject it, but the extent and seriousness of a majority of their discussions indicate that the hypothesis was pressing strongly for recognition. (23) Its lone advocate is RAB HAMNUNA THE ELDER, who is described in the *Zohar* as stating in his "Book" that the inhabited world "turns round in a circle like a ball." (24)

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(21) *E. g.*, HIPPOLYTUS and EUSEBIUS.

(22) Following COLEBROOKE, ĀRYABHAṬA, BRAHMAGUPTA, and PRIT'HUDACA SWAMI are discussed and quoted by J. L. E. DREYER, *History of Planetary Systems*, Cambridge, 1906, pp. 242-243, and by G. V. SCHIAPARELLI, *Die Vorläufer des Copernicus*, Leipzig, 1876, pp. 79-80. On page 272, note, DREYER mentions AL-QAZWĪNĪ (*Kosmographie*, p. 296), where reference is made to the earth moving round in a circle. This may describe the diurnal rotation, but the Pythagorean movement around the central fire appears the more probable.

(23) AL-SHĪRĀZĪ: SARTON, *Introduction to the History of Science*, II, 1017-1018; ABŪ-L-FARAJ: DREYER, *op. cit.*, p. 272n.; AL-KĀTIBĪ: DREYER, *op. cit.*, pp. 271-272; NOVARA: DUHEM, *Léonard de Vinci*, II, 248; Saint THOMAS AQUINAS, *Libri de Coelo et Mundo...*, II, xxvi.

(24) *Vayikra* (Leviticus), 10a. The latest translation of the *Zohar*, by MAURICE SIMON and PAUL P. LEVERTOFF, London, 1933, renders this passage: "The

As a result of the research of such scholars as PIERRE DUHEM and LYNN THORNDIKE, the definite importance and prestige of the conception in the Fourteenth Century is well known. Among early commentators are the unnamed Master at the University of Paris who supported it, (25) and the anonymous author of the "Treatise in Six Books on Metaphysics and Natural Philosophy." To the latter, the idea is "most false," in part because it neither explains such phenomena as eclipses, conjunctions and oppositions, nor why the sun and moon are nearer at some times than they are at others. Moreover, the great velocity of the whirling earth, so the author asserts, would bring buildings down in ruin. (26) In contrast to this opposition was the sympathy or support of active and important writers of the period, including FRANCISCUS DE MAYRONNES, JEAN BURIDEN, WILLIAM OF OCCAM, ALBERT OF SAXONY, and NICOLAS ORESME. (27) In defense of the theory, ORESME presents a variety of arguments, one of which is, in effect, the axiom that Nature and God do nothing the more difficult way :

> It is reasonable that the heavens, which are greater or farther from the center, make their revolutions in greater time than those nearer the center, for if they make them in a period equal or less, their movement will be very excessive... To put in place of this [revolution] one small operation, the daily movement of the earth, which is very small compared with the sky, and to avoid multiplication of operations diverse and outrageously immense, is to follow what God and Nature have made and ordained (28).

The Fifteenth Century finds the publications of two Cardinals at issue over the hypothesis. To PIERRE D'AILLY, the theory is false, but he renders it the service of including it in his *XIV*

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inhabited world is circular like a ball." However, five Hebrew texts of the *Zohar*, selected at random from the rich collection in the Semitic Division of the Library of Congress, give without variation the important key words as *mithgalgel be-igula ke-kadur*, which are : turns round (in a circle) like a ball. See also DREYER, *op. cit.*, p. 272.

(25) DUHEM, *Léonard de Vinci*, III, 249 ff.

(26) LYNN THORNDIKE, *History of Magic and Experimental Science...*, III, 581.

(27) MAYRONNES : THORNDIKE, *Science and Thought in the XVth Century*, p. 141; BURIDEN and OCCAM : DUHEM, *Léonard*, III, 249; ALBERT OF SAXONY : DUHEM, *Léonard*, III, 249 ff.

(28) As quoted by DUHEM, " Un précurseur français de Copernic : Nicole Oresme," *Revue Générale des Sciences Pures et Appliquées* (XX, 871-872), 15 Nov. 1909.

Quaestiones in Sphaeram Joannis de Sacro Bosco, and thus bringing it to the attention of the many subsequent readers of his work. (29) NICHOLAS OF CUSA argues vigorously in support of the conception, and although he later joined with it an illogical movement of the heavens, his advocacy carried distinct weight. (30) We have in addition the suggestive statement by LEONARDO DA VINCI : "The earth is neither in the center of the orbit (or circle) of the sun, nor in the center of the world, but in the center of its elements which *accompany* it, (italies mine) and are united to it." (31) In the important era which is honored with the rebirth of the heliocentric hypothesis, references to the theory again multiply. JEAN-BAPTISTE CAPUANO, who omits discussion of it in the 1499 edition of his *Spherae Tractatus Joannis de Sacro Busto*, suggests the growth of the conception of rotation by adding after 1505 and before 1531 an attack upon it. (32) Two years later the hypothesis is pilloried by JOHANN SCHÖNER, but by way of happy contrast is during this period warmly defended by CAELIO CALCAGNINI, Professor in the University of Ferrara. (33) It is later favorably mentioned in the posthumous Fifth Book of *Pantagruel* where RABELAIS follows an interpretation of ARISTARCHUS and SELEUCUS similar to that presented by PLUTARCH in the *Platonic Questions* :

> Pantagruel... said to us that in his judgment, PHILOLAUS, ARISTARCHUS, and SELEUCUS had previously philosophized on this island, and had expressed the opinion that truly the earth turns about the Poles, not the heavens, although the contrary seems true to us, as when we are on the river Loire, we think the trees move, yet they do not move, for this is only the moving of the boat (34).

In 1556, 1562, and 1596, three mathematicians, ROBERT RECORDE,

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(29) Question III. For a later attack, see REGIOMONTANUS, *Epytoma in Almagestum*, I, conclusio Quinta.

(30) *De Docta Ignorantia*, II, xii; Appendix XV, THORNDIKE, *Science... XV Cent.*

(31) *Les Manuscrits* of Leonardo da Vinci, as quoted by DUHEM, *Léonard*, III, 31.

(32) Venice, 1531, f. 79. As quoted by DUHEM, *Léonard*, II, 250 ff.

(33) IOANNIS SCHONERI, *Opusculum geographicum...*, ch. II, in *Opera Mathematica*, Nürnberg, 1551; " Quod coelum stet, terra moveatur, velde perenni motu terrae, Caelij Calcagnini commentatio," in *Opera Aliqvot*, Basileae, 1544, pp. 388 ff. The index title is " Quod coelum stet, terra moveatur, commentatio ad Bonaventura Pistophilum." The work was apparently written about 1525.

(34) *Gargantua and Pantagruel*, Book V, xxvi.

P. RAMI, and JOHN BLAGRAVE (35) describe the theory, but refer to it as if it were the hypothesis advanced by COPERNICUS. In the case of the two latter writers there is little justification for this ascription; yet in the fuller account of RECORDE one is tempted to find not only the theory of diurnal rotation, but that of the annual revolution as well. RECORDE does state that COPERNICUS placed "the earthe out of the precise centre of the world 38 hundred thousand miles." However, nothing is said of the sun as center or of the revolution of the earth around it. In fact, the only motion described is that "the earthe... moveth circularly about his own centre." (36) In 1578 and 1592 the conception appears in the poetry of DU BARTAS and Sir JOHN DAVIES, the latter of which mentions it in passing. (37) DU BARTAS, as one might expect, stands opposed to the theory :

> So, far do they from Sense and Reason erre,
> Who think the Heav'ns stand, and th' Earth doth stir...
> But who hath seen a Selfly-turning Stone?
> How, then should the earth turn herself alone?
> Let's therefore, boldly with old Truth affirm,
> That th' Earth remains immoveable and firm. (38)

The gifted French poet did not realize that this "new" truth was in reality "old".

In the Seventeenth Century the hypothesis is easily dismissed by BACON as an "extravagant idea," and is pilloried by ELIAS ASHMOLE as one of several "ugly and mis-shapen Lies,". (39) but by contrast is given by such opponents as SCHEINER, MERSENNE, and RICCIOLI, the honor of extended discussion. (40) In 1597, RAMERUS employed it in combination with the geo-heliocentric

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(35) *P. Rami Scholarum Physicarum*, IV, xiv; BLAGRAVE, *Astrologum Uranicum*, ch. XIX.

(36) *Castle of Knowledge*, 1556, p. 164. DREYER and those drawing upon his *Planetary Systems* (p. 346) cite for this passage the *Pathway to Knowledge*, 1551, but neither of the two copies I have seen of this edition includes it.

(37) *Complete Poems of Sir John Davies*, ed. GROSART, II, 87.

(38) *Complete Works* [and translations] *of Josuah Sylvester*, ed. GROSART, II, 87.

(39) *Advancement of Learning*, in *Works*, ELLIS and SPEDDING, IV, 348; ELIAS ASHMOLE, *The Way to Bliss*, London, 1658, p. 13.

(40) CHRISTOPHERUS SCHEINERUS, *In Disquisitionibus Mathematices*, Num. 22; F. MARIN MERSENNE, *Harmonie Universelle*, Paris, 1636, I, 146, and *passim*. GIOVANNI BATTISTA RICCIOLI, *Almagestvm Novvm*... Bononiae, 1651, Books I and IX. RICCIOLI (I, 102) asserts that SCHEINER supports the theory.

hypothesis, a practice which grew in favor until the *Principia*. (41) Such a combination appears to have tempted GILBERT, (42) and gained among others the support of LONGOMONTANUS and ARGOLUS. (43) The theory also is used by CARPENTER and DEUSINGIUS with appropriate portions of the Ptolemaic explanation. (44)

The many advocates of the Seventeenth Century are too numerous for mention here, their leader being the well-known and influential author of the *De Magnete*. (45) Following GILBERT is MARKE RIDLEY, to whom we apparently owe another argument in behalf of the theory, analogy to be sure, but for the day, effective analogy. The telescope of GALILEO had shown the sun and Jupiter in rotation, and not only shattered the argument that heavenly bodies do not turn, but suggested exactly the opposite. On this basis, RIDLEY asserts that one viewing the earth at a distance could see it in rotation. (46) His thinking is in part followed, if not anticipated, by SIMON MAYER, (47) and in the next decade this argument is expanded by Bishop FRANCIS GODWIN. (48) It again appears in the *Journal Des Voyages de Monsievr De Monconys*, where "the heavenly bodies" turn "upon their center, as the sun, the earth and Jupiter." (49)

To those concerned with the effect of scientific theory upon artistic endeavour, perhaps the most important indication of the influence of the hypothesis during the Seventeenth Century is the response which came to it from literary men. Reference begins with JOHN OWEN's epigrammatic attack upon WILLIAM GILBERT for advancing the conception, and continues, among many others, with GREVILLE, DONNE, DRUMMOND, HERBERT,

(41) NICOLAI RAIMARI, *Systemate Mundano*, Pragae, 1597.

(42) *De Mundo nostro Sublunari Philosohpia Nova*, Amstelodami, 1651. JOHNSON and LARKEY, "THOMAS DIGGES"... *Huntington Library Bulletin*, April 1934 (V, 70), briefly discuss GILBERT's definite interest in the Tychonic explanation.

(43) *Astronomica Danica*, I, i and iv; *Pandosio Sphaerico*, 1644, Book III.

(44) *Geography Delineated*, 1625, pp. 76 ff.; *De vero Systemate Mundi*, Amstelodami, 1643.

(45) London, 1600, VI, iii ff.

(46) *A Short Treatise of Mathematical... Motions*, London, 1613, pp. 14-15.

(47) *Mundus Jovialis*, Norimbergae, 1614, as cited by DELAMBRE, *Hist. Mod.*, I, 698 ff.

(48) *The Man in the Moon*, as reprinted in *Anglia*, X, 439-440.

(49) Lyon, 1665, I, 130. November, 1646, « Opinions du Sieur Viviano ».

Third Lord NORTH, LOVELACE, Second Viscount CONWAY, WALLER, MILTON, COWLEY, and DRYDEN. (50) To JOHN MILTON, who devotes to the theory the major portion of the extended cosmological discussion which opens Book VIII of *Paradise Lost*, it is the most vital and interesting of the purely astronomical conceptions of his day. He refuses either to deny or to affirm the truth of the hypothesis, and indeed suggests that this is no concern of man, but the extent and the compelling beauty of his poetic discussion indicate how completely the belief had captured his mind, and to a perhaps lesser degree, that of his contemporaries :

> When I behold this goodly frame, this World,
> Of Heaven and Earth consisting, and compute
> Their magnitudes—this Earth, a spot, a grain,
> An atom, with the Firmament compared
> And all her numbered stars, that seem to rowl
> Spaces incomprehensible (for such
> Their distance argues, and their swift return
> Diurnal) merely to officiate light
> Round this opacous Earth,... I oft admire
> How Nature, wise and frugal, could commit
> Such disproportions, with superfluous hand
> So many nobler bodies to create,
> Greater so manifold, to this one use,...
> But whether thus these things, or whether not—
> Whether the Sun, predominant in heaven,
> Rise on the Earth, or Earth rise on the Sun;
> He from the east his flaming road begin,
> Or she from west her silent course advance
> With inoffensive pace that spinning sleeps
> On her soft axle, while she paces even,
> And bears thee soft with the smooth air along...
> Leave them to God above.

In this summary of the extended history of the theory of the diurnal rotation of the earth, two principal points have been suggested : the conception was influential for centuries as an independent hypothesis, and, it was employed in combination with partially Ptolemaic and geo-heliocentric systems as well as with the Copernican. Neglect of these two commonplaces has brought

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(50) OWEN, *Epigrams*, tr. PECKE, p. 4; GREVILLE, *Works*, ed. GROSART, II, 16; DONNE, *Devotions*, 1624, pp. 511-512; DRUMMOND, *Works*, ed. KASTNER, II, 59; NORTH, *Varieties*, 1645, p. 169; LOVELACE, *Poems*, 1921, II, 85-86; *Conway Letters*, New Haven, 1931, p. 32; WALLER, *Poems*, ed. THORN DRURY, I, 123; COWLEY, *Poems*, ed. WALLER, p. 413; DRYDEN, *Poems*, ed. NOYES, p. 16.

needless error and controversy into the history of science. (51) In Seventeenth Century literary history and special editions of authors, this neglect has led to more numerous errors, one of which is the labeling of any description of the earth in rotation as reference to the Copernican Theory. On this basis, those writers who considered it unimportant whether the earth or the heavens turned are described as stating that the heliocentric conception was unimportant.

A second error, occasioned in part by ignorance of the activity of the geo-heliocentric as well as the conception of diurnal rotation, is the assumption that as late as 1650, England (or perhaps Europe) was confronted by two rival systems, the Ptolemaic and Copernican. (52) That these, and other misconceptions have distorted the history of science in the minds of thousands of students of literature goes without saying What is not so obvious is that these half-truths have occasioned profound misunderstanding of literary references, and among other things have placed such a poet as MILTON in the unique position of employing, and in the same work, vigorously attacking and ridiculing the medieval revision of the system of PTOLEMY.

Smith College. GRANT MCCOLLEY.

(51) *E.g.* HERACLIDES and NICHOLAS OF CUSA.

(52) This paper is the first of a series of studies first presenting and then evaluating in terms of their relation to English Literature of the Seventeenth Century, the five cosmological conceptions active during this period: the variations of the Ptolemaic interpretation, the theory of diurnal rotation, the Copernican hypothesis, the geo-heliocentric system, and the doctrine of a plurality of worlds. The second member, " The Seventeenth Century Doctrine of a Plurality of Worlds " is forthcoming in *Annals of Science.* The third member. in preparation, is " The Astronomy of *Paradise Lost* ".

Turkish Medicine

In 1933 History of Medicine was added to the courses given by the Faculty of Medicine in the University of Istanbul. Dr. SÜHEYL ÜNVER was appointed to give this course and also the course in deontology, added to the curriculum at the same time. Later in the same year the Institute of the History of Medicine was established and affiliated with the University. It hopes to bring to light many unknown facts concerning especially the history of Turkish medicine, a subject to which little study has been devoted up to the present time. The Institute collects pure Turkish medical terms from the early documents and manuscripts, and in this way is doing its share in the more general attempt of *Türk Dili Araştirma Kurumu* to bridge the gap formed uring previous centuries between the spoken and the written languages. Furthermore work is being done in collecting material and studying the Turkish folk medicine, which is being replaced by the practice of modern medicine. (1)

The Institute has a rich library which is rapidly increasing, and museums devoted to medical folklore and the history of medicine.

Since the spring of 1935 the Institute has published *Türk Tïb Tarihi Arkivi* (The Archives of the History of Turkish Medicine), a quarterly organ. It has also published many pamphlets during three years of its existence. The quarterly is edited by Dr. SÜHEYL ÜNVER and Dr. FERİDUN NAFİZ. Some of the publications of the Institute are accompanied by French translations or summaries in French.

The sources used for preparing this paper consist of issues 2 and 3 of the *Türk Tïb Tarihi Arkivi*, and in additions to these the miscellaneous works of Dr. Ünver.

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(1) It is an interesting fact that the medical folklore can, in many cases, be traced back to the earliest Turkish medicine studied, the Uygur medicine.

We shall first consider Uygur medicine (2) which was pre-Islamic, and following brief references chiefly concerning the pre-Islamic medicine of other Turkish people we shall consider the period starting with the Turkish establishment in Asia Minor.

Our knowledge of Uygur medicine is based on the documents found in Turfan by ALBERT VON LE COCQ (1862-1930) about 25 years ago. The documents have partly been deciphered and studied by Professor G. R. RAHMETİ of the University of Istanbul (3). They show that the Uygurs possessed a sound and well defined medical knowledge. Their medicine was secular, and free from spiritual and magical or religious elements, which at that time dominated most parts of the world; nosology, pharmacology, and therapeutics were generally based on objective observation and research. (4)

The Uygurs possessed many special instruments for the preparation of medicines. Reeds were used to blow certain drugs down the throat. They had a variety of drugs which were not only of vegetal and mineral, but also of animal and endocrine origin. The time of taking the medicines was not immaterial with the Uygurs; they specified definite times, days or hours. (5) Indications of the existence of opotherapy in the Uygur medicine are not scarce. Among the drugs of animal origin were faecal materials and urine.

Many of the pharmaceutic forms of today, such as salves, ointments, infusions, decoctions, powders, mixtures, juices, solutions, pastes, and pills existed in the Uygur medicine. They had specific methods to be followed strictly in preparing the medicaments; e. g., drying in the shade, boiling away to a given volume and consistency. For the preservation of some of their

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(2) The climax of the political and military power of the Uygurs was in the eighth century of the Christian era.

(3) G. R. RAHMETİ : *Zur Heilkunde der Uiguren*. I, II. (Berlin, 1930, 1932).

(4) However, for the treatment of some diseases, human milk was considered useful, but only when it came from a woman who had given birth to a male. See also footnote (5).

(5) One example of this is the rule which prescribes the use of certain medicines on the second day of the new moon. This is clearly astrological in nature; nevertheless the definite specifications of time are in general based upon sound medical grounds; this can be clearly understood from the statements of Dr. ÜNVER concerning this matter.

medicines they plugged the container with mud. All this suggests that the preparation of drugs was intrusted to specialists.

The Uygur physicians had an extensive knowledge of posology. Special attention was attached to the place of application of the drugs. The medicine was usually mixed with food. Besides concealing the bad taste of the medicine, this served to control the food of the patient. In general, food materials were also used for treatment.

A great majority of the drugs used were produced in their own country, a small part, not obtainable within their own territory, being imported from India. The names of the drugs that have been recognized are Turkish, and most of the pronunciations are close to modern Turkish. There are many medical terms, the meanings of which have not as yet been found, especially names of some diseases. For instance, it is not known at all to what such terms as *ürmen* sores and the *karakandus* vomitions, correspond. The *ürmen* sores are divided into 18 kinds, and from the descriptions given some of these resemble secondary syphilitic sores.

Descriptions and classifications have been given of numerous diseases, cutaneous, otological, rhino-pharyngeal, ocular, respiratory, cardiac, digestive, nervous, urinary, genital, and infectious. Usually hygienic advice has been added.

There are many explanations of symptoms and causes of diseases, as well as comments on the results obtained, and it is mainly from this angle that the Uygur medicine reveals its scientific spirit. They pointed out the curable among the diseases, and gave the treatments necessary. Some are indicated as incurable. In some cases, drugs, accompanied by the note, "It should be helpful", are recommended. The description of the changes, and humoral effects brought by curable and incurable diseases are given.

The paper bearing the title "Three illustrations of the medicine of the Uygur Turks" written by Dr. ÜNVER, deals with an Uygur medical document in the form of a roll, containing three pictures. Two of the pictures present a seated, and one a standing human being. The different parts of the body are shown by dots, and there are lines connecting these with the names of the places dotted. Texts accompany these figures. In the picture with

the standing human being, names are not given. This document contains precious information on the anatomical knowledge of the Uygurs, and puts our knowledge of the Uygur medicine on a sounder basis.

The Uygurs represent only a part of the Turkish-speaking people of Central Asia, and their government is only one of the governments founded by the Turks in Central Asia. We are not in possession of documents that would make a more comprehensive study of the pre-Islamic Turkish medicine possible. (6) The political power of the Uygurs lasted until the invasion of CENGİZ HAN. During this period the Uygurs remained outside the influence of the Islamic world, and preserved the pre-Islamic Turkish medicine. The documents concerning Uygur medicine are of great importance for the history of Turkish medicine and it is hoped that the study of the texts not yet deciphered will enrich our knowledge. The part already studied has established in a large measure that there was already a solid body of Turkish medicine thirteen centuries ago.

One of the documents for the study of Turkish medicine is the *Kutadgu Bilig*. (7) This book praises the merits and competence of the physicians, states that they had a high standing in the Karahanli Turks' society, and also advises the people to hold their physicians in great respect.

According to Chinese documents, in 730 A. D., a Turkish doctor, NANTO, sent to China as ambassador from Toharistan, had taken with him a number of medicaments that were unknown to the Chinese up to that time. The Chinese sources also record the existence of 200 medical preparations and many kinds of perfumes among the offerings sent from the Yabgu (8) of Toharistan to the Chinese emperor, in 759 A. D.

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(6) See footnote on p. 403 bearing in mind that the Turks coming to the West cannot clearly be shown to have detached themselves from the Uygur groups. The Turks who migrated to Asia Minor belong mostly to Oğuz Turk groups.

(7) The *Kutadgu Bilig* was composed by YUSUF HAS HACİB in 1069-1070, and dedicated to TAPGAÇ BUĞRA HAN EBU ALİ HASAN, the sovereign of the Karahanli Turks. The original copy was written in the Uygur alphabet. This book reflects the customs and life of that age, and describes different classes of the society. It is of interest not only as a medical document, but in many other respects. The words *Kutadgu Bilig* mean the knowledge that brings happiness.

(8) Yabgu is a title given to governors who were practically independent rulers.

İBNİ KUTEYBE (9) in 890 A. D., mentions in his book *Tevili Muhtelifülhadis*, that at Horasan, a well-known Turkish physician treated many diseases, such as fever, meningitis, dropsy, paralysis and others by means of cauterization.

The Turks accepted the Moslem religion and became part of the Darülislam. Furthermore the translation of the Koran had been forbidden, and Arabic had become the tongue of letters and sciences throughout the Moslem world, as Latin was in the Occident during the Middle Ages. These conditions make it very difficult to determine the contributions of the Turks to Islamic medicine. There are good reasons, however, which lead one to believe that these contributions were important. However, this matter has not yet been studied sufficiently and we shall omit any reference to the share of the Turks in the Islamic medicine, and pass on to the period which starts with the Turks' establishing themselves in Asia Minor.

The study of the hospitals is a very useful and instructive one for this period. Hospitals were located in different cities, such as Kayseri, Konya, Sivas, Bursa, Istanbul, Edirne, Kastamonu, Amasya, and Manisa. Each of these hospitals was a sort of medical school where medicine could be studied at the bed-side of the sick, and some of them have been the nurseries of many distinguished physicians. There were also medical schools which were especially established for teaching purposes, such as the school at Kayseri (founded in 1205), (10) and the schools in Amasya (1308), the medical school of FATİH in Istanbul (1470), of Süleymaniye in Istanbul (1555), and the medical school of BAYEZİT II in Edirne (1485). There were also students training under physicians in the capacity of apprentices.

The hospitals were similar to a polyclinic. All treatments

(9) I spell Oriental names according to the modern Turkish rules. Ibni Kuteybe's name is written Ibn Qutaiba by western orientalists.

(10) The school and hospital were both built by Princess GEVHER, daughter of KILIÇ ARSLAN, king of Anatolian Selçukids, and the name "The hospital of Princess GEVHER" refers to both of them. They are also called *Çifte Medrese* (meaning twin universities) because they consist of two adjacent buildings. Only their ruins remain today. The hospital part contained 13 small rooms, 3 large halls, and 3 galleries with columns. The adjoining school of medicine contained 10 rooms, 2 large halls, and 3 galleries. These two buildings covered a surface of 2400 m^2.

and also medicines were given free of charge to outdoor patients as well as to others. These hospitals contained a pharmacy and were supplied with places for isolation. They were under the direction of a central administrator, namely the Head Physician, who would be called a Minister of Public Health today. In Asia Minor these hospitals date from the beginning of the 13th century, the first one being the hospital at Kayseri, founded in 1205.

Some cities had more than one hospital. All were built in conformity with the rules of hospitalization. The inscriptions decorating the doors indicate this clearly. These hospitals received rich incomes from the Evkaf (an organization supervising the use of the endowments of pious and charitable nature). Most of them had a department set aside for the insane. In some cases music was used as a means of treatment for the insane. There were also quarantine buildings. The first lazar-house known in Turkey was established in the first half of the 15th century in Edirne.

The following brief accounts of two hospitals give a fair idea of these early Turkish hospitals.

The Hospital of FATİH was built in 1470 by FATİH (MOHAMMED the Conqueror) in Istanbul. It was the first one built in Istanbul and the 12th after the one in Kayseri, built in 1205. The buildings do not exist today. According to EVLİYA ÇELEBİ, famous traveller and writer of the 17th century, the hospital contained 70 rooms and had 200 attendants. FATİH also founded the Academy of medicine bearing his name (1470). The students attended practical courses in the hospital after finishing their studies in the University. The number of people employed in this hospital, according to the records of the Evkaf in 1470, was : one head physician, another physician, an oculist, one surgeon, one druggist, one manager, one superintendent of provisions, one janitor, two cooks, one doorkeeper, two nurses, one servant, and fifty attendants. FATİH also built, among other charitable institutions, a sanitarium, and an imaret (public cuisine), and in Istanbul, as EVLİYA ÇELEBİ records, a hospital for women and one for Christians.

The Hospital of Süleymaniye, its medical school and pharmacy were built in 1555 by SÜLEYMAN the Magnificent. (11) The

(11) The builder of this hospital was MİMAR SİNAN (1490-1588), the greatest

hospital contains twenty-six rooms. It is one of the most important among the hospitals of this period. It contains baths, doctors' departments, isolation places for the insane, etc. The list of doctors includes several specialists in the treatment of internal diseases, assistants, surgeons, oculists, and druggists. (12)

Continuing the older tradition there was a very good organization for maintaining personal hygiene. Great importance was attached to sanitary service as well as to public assistance. The construction of public baths, hospitals, sanitariums (usually built beside the hospitals to receive the convalescing patients), imarets (charity homes, where food was distributed free of charge), kervanserays, and fountains were the first public projects in a city taken over by the Turks. The city of Kütahya provides a document of great interest concerning this subject. It is an inscription, dated 1411, on the wall of an imaret, constructed by YAKUB ÇELEBİ, last of the Germiyans, one of the ruling families of Kütahya. The 28th and 29th lines read as follows :

"Let the horses of the visitors of the imaret be given food for three days, and, according to custom, let food and bread be given in abundance to the visitors, and to their retinue,"

"and let the food left over be distributed to the neighboring people, and also, for whomever falls ill let a doctor be brought, and treatment given, and let the imaret pay for the doctor and the medicine."

It was not unusual among the Turks, as seen in this example, to bequeath their fortune to institutions of public assistance built for medical, sanitary, and for purely charitable purposes. The archives of Evkaf supply us with authentic documents concerning this matter. The baths and hospitals as well as the others were free of charge. The fountains were located not only in towns and villages, but also on country roads between towns.

The ancient system for sewage disposal in the city of Istanbul is very important from the point of view of hygienic considerations.

The thermal springs in the country have always been used;

Turkish architect. Among his architectural works, nearly 500 in number, there are four hospitals, fourteen imarets, and thirty-two public baths.

(12) For comparison with the Islamic hospitals in general, refer, for example, to Dr. AHMED ISSA, *Histoire des Bimaristan à l'époque islamique* (Le Caire, 1929; *Isis* 14, 535).

people have always sought recovery through them. Records exist also of thermal springs that were used for horses.

The manuscripts of this time contain advice concerning preventive hygiene besides therapeutics. Many attempts have been made to raise the morale of the people in facing contagious diseases. Variolation against small-pox had been practiced in Asia Minor, Edirne, and Istanbul long before the time Lady MARY MONTAGU informs us about it. (13)

Many books have come down to us from the physicians of this period. The first medical text of the post-Islamic period written in Turkish, known at the present time, was written in the year 1389, *Havasüledviye*, by İSHAK BİN MURAT. It will be useful to consider two manuscripts in order to form an idea of the knowledge of the physicians of this period. Further material, making a more complete account of it possible, was not available. The following account is taken from the paper *Sur un manuscrit médical illustré du XV^e siècle* of Dr. ÜNVER, presented in 1932 to the ninth international congress of the history of medicine in Bucharest. The quotations given below are from this paper. The manuscript to be considered is from the year 1465. (14) Its title is *Kitabülcerrahiyei İlhaniye* and the author, SABUNCU OĞLU ŞEREFEDDİN BİN ALİ. He was physician at the hospital of Amasia, and wrote this book at the age of 63.

The manuscript *Kitabülcerrahiyei İlhaniye* contains 398 pages. It has 49 illustrations, and 163 figures of medical instruments. The book is in three parts. The first part deals with cauterization (57 chapters), the second with minor surgery, eye diseases, and obstetrical interventions (97 chapters), and the third part with orthopaedic problems (36 chapters). At the end of the book a

(13) In her letter to Mrs. S. C. in 1717, Lady MARY MONTAGU gives an interesting account of her observations on variolation against small-pox in Edirne, and she says she will try to propagate this habit in England. Letters of Lady M. MONTAGU, Letter XXXI, pp. 151-54, London, 1793.

We know that she had her own children inoculated, and also that she encountered a vast amount of prejudice in bringing the matter forward in England.

(14) In *Sur un manuscrit médical illustré du XV^e siècle* it is said that SABUNCU OĞLU ŞEREFEDDİN was the first among the physicians of the post-Islamic period to write his works in Turkish. But in his later papers Dr. ÜNVER mentions other medical books written in Turkish in the 14th century, the first being in 1389. Apparently these books were not known at the time the first paper was prepared.

formulary with the description of the preparation of different medicaments is given.

"The author gives the description of different diseases, and indicates their course and their prognosis. We observe that he possessed a scientific spirit very close to that of the moderns. When speaking of therapeutics, he clearly describes the methods of application. He advises to tabulate the results obtained and the development of the disease while the treatment lasts."

He warns us that all the methods that he recommends do not suit always all the patients and insists upon the necessity of individualizing cases.

"Before most surgical interventions he finds it necessary to make an internal treatment, and he also recommends appropriate and prolonged care following the operation."

"Cauterization by iron, and by caustic substances occupy a large space in his book. But he does not recommend them at random, he strongly advises against deep cauterization for diseases that may be connected with the viscera."

"The principal diseases treated by this method are the following: Sciatica, hemorroids, warts, dropsy, arthritis and also leprosy."

He attaches great importance to the psychology of the patient, and cautions against the methods capable of frightening him.

"His knowledge of anatomy is good. He says to avoid deep cauterizations in the neighborhood of the arteries and nerves. He points out the danger of hemorrhage which he knows, however, how to treat by compression or by ligature of the vessels. He notes the vasoconstrictor effect of cold water and of a few other substances. From the point of view of internal treatment he draws attention to the importance of hygiene and of an appropriate diet. In describing the operations he does not neglect to define the duty of the assistants. His way of operating the herniae resembles the modern methods to a certain extent. He confines the patient to bed for 40 days, and takes care to avoid constipation. He deals with the strangulated herniae and their fatal effects. He cauterizes the sores of leprosy, and in this instance points out in the diseased ones the anesthesia to pain."

"He knows how to perform the delicate operations of the eye. He makes use of silk-thread to sew the wounds. He attaches a certain importance to the reaction of the organism. He advises

the bathing of the eyes with boiled water. He repeats frequently that when a method does not give good results it must be abandoned."

"In the chapter on warts he talks of cancer, and advises strongly not to touch it for fear of giving rise to fatal complications. He forbids especially to cauterize the center of the ulcer, even when it is purulent. Before intervention with the diseases of the mouth he demands the making of gargarisms."

"He describes the various means of extracting teeth, and draws the attention of the operator to the fact that he must not rely upon the statements of the patient, but must verify for himself whether the tooth indicated is really diseased. He knows how to fix loose teeth with golden wires, and comments on the ways of replacing the extracted teeth with artificial ones carved from bones of calves."

"He advises ablation of hypertrophied amygdala and indicates the tracheotomy in the diseases of the larynx which cause asphyxiation. He is acquainted with the aneurisms, and cautions the physicians against the danger of touching them. He knows the treatment of filariasis as it is still applied today. He knows how to drain off ascites with a trocart of his invention. But he is cautious not to drain off all the liquid because of danger of death, and observes the pulse during the whole operation."

"He also describes how to probe into the bladder, and in cases where it is indicated he uses a permanent probe. He washes this organ with a syringe with piston which he has invented. He deals with lithotrity, but advises not to practice it in case of large bladder-stone, and in this case prefers cystotomy. The treatments he applies to hydroceles and varicoceles approach modern methods."

"At this time the midwives only could interfere in the childbirth. He indicates to them the way to operate, and the various complications that may occur. When the child is dead in the matrix he knows how to remove it by basiotripsy."

"He takes up the subject of hemorroids, and indicates very interesting methods. For the internal hemorroids he advises cupping which draws the tumor to the outside, and in this way makes it visible."

"He also mentions medical deontology. He recommends to

the physicians not to do anything that would diminish their prestige in the eyes of the people, tells them to be conscientious, human, not to be much on the look-out for money, to give great attention to the prognosis of diseases, and to be cautious with incurable cases. He also says that one should not forget that patients have different moods and characteristics, and that nothing should be neglected to avoid hurting them."

In order to form an idea of the anatomical and physiological knowledge of the physicians of this period, we shall now consider the illustrated manuscript *Risalei Tarihi Ebdan* written by ŞİRVANLI ŞEMSETTİN, sometime between the years 1662 and 1648. The book is in Turkish, and contains more than 30 illustrations. Especially the pictures on the skeleton, nerves, the arteries, the veins, the excretory system, and the position of the embryo in the womb are very valuable. The illustrations are schematic and clear, and the work is specially valuable from this standpoint. The author has been careful to use pure Turkish terms and expressions. His statements are very clear and well defined.

He has studied many books in preparation for this work. He incidentally points out the disagreements between his sources. He gives the example that, according to İBNİ SİNA, the number of muscles in the body is 529, and according to GALEN 518.

At the beginning he talks about the four elements, the four humors, and the different constitutions and dispositions, and gives accounts on the embryo.

The anatomical section deals with bones, cartillage, nerves, muscles, veins, arteries, brain, head, thorax, abdomen, etc. When required he deals with local anatomy. In connection with the organs he deals with the pathological cases also, and in this connection talks about many diseases.

He has a good knowledge of anatomy. He gives examples from HIPPOCRATES, GALEN, "DEMOCLIS", İBNİ SİNA, NİŞABURLU EBÜLKASIM, and does not hesitate to point out their errors, as well as their statements which he considered to be correct.

The section on digestion and the digestive organs is the most important part of the book. He has a good grasp of the transformation of the food materials.

European influences on Turkish medicine began as early as the time of the Turkish conquest of Istanbul. In the 16th and

17th centuries some physicians were already quoting from European texts and to a greater extent during the 18th and 19th centuries. In the year 1827, the Medical School of Istanbul was opened. With this we see a marked European influence coming in. Part of the instructions had been given in French until the year 1864. This school has developed to its present stage, in a rather continuous way during its history of a little over a century. In the academic year 1922-1923 it was made co-educational. In 1933, it underwent further reorganization together with the other parts of the University, and as was mentioned before, the history of medicine was added to the courses given. Coming back to the study of the history of medicine we see the interest for this subject dating back to the year 1886. In this year Dr. HÜSEYN REMZİ published a book on the history of medicine. He intended to publish his work in three volumes, but died after publishing the first. During the following years miscellaneous papers appeared, and also some books on the history of medicine, until the establishment of the Institute brought new vigor to this study.

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Lappic Medicine

A recent book, *Lappische Heilkunde*, by J. QVIGSTAD (1), is an ethnological treasure trove for a historian of medicine, for it not only gives us a living picture of medicine from the time of HIPPOCRATES to the Middle Ages, but shows us a nation of nomads enacting in the twentieth century what was common among the wandering nations of the early Middle Ages. Russian, Finnish, Swedish, and Norwegian writers have all brought out the characteristic and comparative habits of these descendants of the hordes of barbarians, Huns and Slavs and Goths, who swept over Europe from the fourth to the tenth centuries. In their physiognomy the Lapps and Finns still betray their Mongolian ancestry by their broad and flat heads and high cheek bones. In view of their isolation it is perhaps small wonder that they did not progress at all before the seventeenth century, when, for the sake of winning his religious wars, GUSTAVUS ADOLPHUS somehow thrust some of them into his army where they had a glimpse of the great world. Evidently, however, their reindeer and dogs proved more alluring than civilization, and even the soldiers soon relapsed into their old dreamy ways. The large majority of the Lapps now belong politically to Sweden and Norway, which exploit their vast mines of iron and copper and, in return, provide schools during the winter for those who care to study, and modern medical care for those willing to submit to it. Consequently, Lappish traditions in the main are those of the Finns and Russians of the tenth century, but their native medicine comes directly from the Arabs and quacks and soothsayers and seers brought to them by travelers long ago.

QVIGSTAD himself believes that the superstitions of the Lapps

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(1) These notes are in the main taken from a book by J. QVIGSTAD, *Lappische Heilkunde*, published by the Institute for Comparative Studies of Culture, Oslo, 1932, pp. 270. (Cambridge, Mass., Harvard University Press).

are especially those of the pre-Vikings. They believe that dead relatives, ghosts, witches, and huge stones are able to exorcise devils which cause disease, and a picture of a saint or the rude drawing of an enemy is efficacious in driving away evil and curing a disease or *vice-versa*. A child should be named for a good relative else it is likely to inherit only the bad qualities of a bad one. Thunder-stones and sea serpents are to the Lapps objects of veneration; frogs are supposed to have been created for the sole purpose of acting vicariously in taking to themselves man's diseases, and amulets of bear's teeth are worn from the cradle to the grave for personal safety. There is scarcely a plant or insect or any tissues or excretions of any animal considered useless in their pharmacopeia. Human urine, reindeer dung, and bear's gall are their specifics for the cure of many diseases. But, wisely enough, their healers must be paid before beginning the cure. Sweat baths are commonly used as in old Finland for all kinds of infirmities; puppies boiled in oil as in the Far East for rheumatism; any meat brew as in old Bavaria for a tonic; powdered reindeer horn for strengthening muscles, teeth or bones, as in ancient Rome; a pair of soiled stockings are always kept unwashed ready to be wrapped around the neck for curing a sore throat.

As women were priestesses and soothsayers in Greece and Rome, so in Lappland today certain women are considered almost holy, because, by their intuition and traditional learning they seem the more able to cure the sick than are university trained medical men who occasionally visit them.

Among their most famous healers QVIGSTAD (pp. 5, 6), has found data concerning the following women, either still living or alive in the memory of his informers: SOPHIA FORSNER, a pastor's wife who was a practitioner at the end of the eighteenth century; KRISTINA KATRINA OLSDATTER, from Tana, a Sea Lapp, born in 1859; ELISA GAKKO NILSDATTER, born 1868; KRISTINA BAVDA MIKKELSDATTER, born 1856; INGA GAUP, the daughter of NILS of Larasjok, born 1862; SUSANNA SPEIN, born 1858, the daughter of ANDERS, a nomad physician; ELEN UCCE JONSDATTER, born 1902; SUNNA of Lenvik, born 1838, a famous nomad, daughter of another OLS; SOFIE NILSEN, born 1857 in Wefsn, mother of a well educated physician; KRISTINA MARGARETA JOHANSEN, born 1873 in Wefsn, from whom QVIGSTAD got much of his

information. However important these women were or still are, we find much of their treatment as old as that of the pre-Hippocratic medical men. For example, INGA GAUP and SUSANNA SPEIN often use magic with their remedies. Their words are a great secret, not to be given to any other human being, else their own power would vanish into thin air, never to return. INGAR NILSDATTER, who found a human bone in the forest of Ibbestad, in 1827, buried it so secretly that she was soon visited by its owner by whom, as by divine revelation, she was gifted with all healing powers. She was, moreover, a noted and successful midwife. The stock in trade of INGER MIKKELSDATTER, born 1759, was rather inflammable, consisting of a flint stone and tinder with which to make a fire, and twigs and berries of juniper, and willow leaves and bark. INGA taught her granddaughter the art of medicine and bestowed upon her the right to use certain meaningless mumblings which cured multitudes and gave her a good reputation for medical skill and spiritual holiness. She died in 1870.

Turning the pages of QVIGSTAD's book rapidly we see the names of these healers frequently repeated. For instance, we find SOPHIA FORSNER treating a rachitic child with a mixture of beaver's gall, powdered renal stone, and daphne berries, her favorite remedies. She used the blood of a black cat as an application to erysipelas, which was a common disease.

INGA GAUP treated a young girl for delayed menstruation by hot drinks of salt and vinegar, or by bleeding from the feet; for profuse menstruation hot coffee was her remedy; for dysmenorrhea she caught a bewitched insect, boiled it in rum and gave it to the patient. For the aphthae or sore mouth of a child she swabbed its tongue and mucous membranes with its own urine. She treated eczema with lotions of weak tea and blubber, to which were added sulphur, turpentine, and dog's fat. For severe burns she used an application of fresh blood of a reindeer or its urine. For scabies she applied strong tea and salt, but to avoid infecting her own fingers she held them over the flame of a wisp of burning hay until they were almost blistered.

SUSANNA SPEIN seems to have been somewhat of a skin, throat, and eye specialist. She used potato flour and powdered birch bark, sphagnum moss, or lycopodium powder as a dressing for

eczema and impetigo and other external inflammations. She had a unique method of treating "canker mouth," by mixing urine with unsalted fat into which she dipped a piece of black wool and applied it to the inflamed spots. For sore throat she spat on a soiled stocking, mumbled certain phrases over the child or patient and then tied the stocking around its neck. This stocking must needs be very soiled and used for three days in succession. Another remedy for sore throat was a mixture of butter and flour or wet wood ashes, externally, together with sweating and severe rubbing of the entire body. This treatment was also used for scabies. To remove a foreign body from the eye SUSANNA turned the upper lid inside out swept her finger across it, and then washed the eye with human milk. Other healers use a smooth toe-bone of a reindeer to remove the foreign body, or a gold ring, or a bit of lead, or a few crumbs of sugar which cause the eyes to water profusely. Sometimes they wash the eye with urine, but it must be the urine of the opposite sex from the patient. Blue-stone wet with spittle is often used for trachoma or conjunctivitis. This is the painful but approved method in Morocco today and it is used with terrible energy.

There are many other remedies commonly supposed to be of value externally, in sickness. As in very ancient times, a frog, small, green, and spotted, is spread apart and bound tightly to an inflamed joint, or a live crow is split in two and applied to an abscess, or bandaged over the abdomen in a case of puerperal fever. Many of the healers, both men and women, use their tongues to lick or suck a man's wound as we have found was done by loving wives, in Salerno, in the eleventh century. KAREN KLEIN's daughter licks the eye ball or lids of a patient to remove a cinder or other speck and she then applies leeches beneath the eye, to soothe the inflammation.

The common household remedies of the Lapps include dock, angelica root, formic acid, sulphur, camphor, pepper, bear's grease and gall. Many of the dried or smoked internal organs of animals native to Lappland are freely used according to the old theory that like cures like; for instance, the lungs of an animal are still given for coughs, brains for mental aberrations, etc. Certain holy wells provide special curative water for certain diseases; a snake drowned in brandy and used in a tea is prescribed to cure

malaria, but, according to DOROTEA NANSEN, the snake must be caught before the cuckoo sings in the spring. In 1897 a well-known healer named WILHELMINA praised this treatment and had many other notions as well for the curing of chills and fever. Living lice are swallowed to cure jaundice, a draught of reindeer blood is used to vomit a patient who has inadvertently swallowed a cockroach, a tea of potentilla root mixed with pepper and powdered charcoal and boiled in milk is said to cure diarrhea. To ward off contagion many Lapps wear a piece of angelica root in the bosom. For obstipation they take a hollow stick of wood, cover it with a layer of reindeer's peritoneum, and with it give the patient a rectal enema. Spider's webs are the common styptics, and, if mixed with urine and " old fat ", they act more expeditiously. *Achillea millefolium*, common yarrow, mixed with lycopodium and birch bark powder and rotten eggs, is considered a good healing remedy for an infected wound. Setons and moxas are used for chronic inflammations, and a black woollen string or colored yarn tied around a finger or around the body is the treatment for lameness from arthritis. Warts are driven away by touching the key of a church door, or by offering a certain prayer at the time of the full moon in Advent, or by applying an old rag to the wart, burying it in the ground or dropping it into a well, after making an appropriate prayer to some mythological goddess.

AXEL MUNTHE, (*Story of San Michele*, 1929, pp. 126-128), once interested himself in the Lapps and found them believing firmly in the " little gnomes " who are able to help people in trouble and in sickness, and in certain devout healers, generally women, whose stock in trade was chiefly mercury and sulphur, like that of PARACELSUS; their remedy for coughs was a live frog boiled in milk, for jaundice it was ten live lice boiled also in milk, for fever it was tobacco, *ad lib.*, as a poultice or snuff. For a wound made by the bite of a dog they used the blood of the dog rubbed with great friction into the bleeding flesh of the patient and covered with lamb's wool.

Since to the Lapps there is scarcely a product of nature not valuable medically, we see the need of expert healers and even skilled priests and *wise women* not only to diagnose a disease and prescribe the correct treatment, but also to get the help

of the patient's spiritual *Hamm* or *Double* in order to protect his corporeal body the more effectively (2).

The obstetric methods used by the Lapps are, in the main, those of all primitive people. Their astrologists and midwives tell the sex of an unborn child by the stars and also predict its birth, whether easy or difficult. If the predictions are for a difficult labor there are certain pagan rites and goddesses to implore, together with the sacrifice of a dog. At the time of labor the midwife gives the patient a quart of melted blubber to drink, or a solution of the gall of a crow, or the blood of a certain bird, or a mixture of urine and herbs. Abortions are brought about for certain reasons, chiefly infidelity. The midwife understands the use of laminaria tents placed in the *os uteri* for this purpose, and prescribes for the patient a diet of raw cat's meat and mercury. Longings for certain foods during pregnancy, and morning sickness as well, are allayed by feeding bread and butter or cheese to a dog or cat with appropriate ceremony. There are many superstitions as to the posture of a woman during labor. If her feet are seriously swollen she may lie with the feet elevated, but otherwise she must walk continuously in her tent, supported, if needs be, by two nurses, and she is forced to drink more or less brandy. In some districts, during the second stage, she kneels, leaning upon her husband or the midwife, who is colloquially called the " back-mother " or " supporting mother." SUSANNA SPEIN, in a slow case gives vigorous massage to the patient's abdomen and sacrum. In the case of mal-presentation of the foetus INGA GAUP performs version by bending the patient's spinal column as far backwards as possible with the husband's help, in order " to withdraw the infant into her body," and then two strong men give her many a twist or jounce, or a violent shaking, to induce the unborn infant to turn itself so that it can be born without further delay. It may happen, however, that the baby refuses to come forth until it hears the name of its rightful father, and even then the poor mother may have to be held upside down to enable the child to " kick its way out." During this miserable mauling she eats two crushed vertebrae of a dead

(2) QVIGSTAD gives one hundred and forty references to elucidate this subject, among them two by himself, *Lappischer Aberglauben*, 1920, and *Lappiske eventyr og sagn*, 1929 ,and one by WIKLUND, *Lapska seder och föreskrifter*, 1911.

snake, and intermittently is enveloped with steaming hot blankets, or she is surrounded with bags of hot hay, and continuously rubbed or pummeled to hasten matters. The mother is, however, seldom sacrificed for the sake of giving birth to a living infant, for the midwives know how to extract the child by their hands or hooks, first having removed an obstructing arm or head.

For arresting a hemorrhage after the birth of the baby the Lapp midwives boil a swallow's nest in milk and give it to the patient as a drink accompanied by prayers and incantations. If the delivery of the placenta is unduly delayed, the patient is made to vomit by tickling her throat with a straw, or she must eat melted butter while the midwife places poultices of hot reindeer moss on her abdomen, or she blows rapidly into a large bottle while the midwife compresses the uterus. SUSANNA SPEIN placed hot sand bags on the sacrum to ease the after-pains and hasten the delivery of the placenta. One case was related of a patient who was jounced " pig-back " by her husband until the placenta and " rivers of blood " covered the floor. After such a performance Frau FORSNER anointed the mother's body with blubber and cranberry juice, gave her raw meat to eat, and wine or milk flavored with ginger, salt, and brandy, to drink, and sometimes a dose of *sarakka*, a cathartic plant of ancient mystical reputation found in China or India, to move her bowels freely and cause uterine contractions. Frau FORSNER adds that she " never lost a mother."

INGA GAUP, on the other hand, gives a bleeding patient warm reindeer blood to drink, and forces her to eat reindeer tongue and liver. If the patient is cold and clammy in shock INGA surrounds her with hot stones or sandbags, or warm ashes, and gives her many kinds of medicated drinks as hot as possible to stop the chill.

Queer customs are traditional as to the cutting or tearing of the umbilical cord. Sometimes it is cut with scissors nine inches from the child's navel, sometimes it is torn quite close to the body, sometimes the stump is burnt, sometimes merely covered with a scorched rag soaked in tobacco juice. The baby's abdomen is then tightly bound to arrest hemorrhage, or the nurse pinches the cord until bleeding stops. If the child does not react properly to the tobacco but seems limp and moribund the midwife blows

into its throat, slaps its back, and sucks the mucus from its mouth until it revives or succumbs.

After a normal birth a baby is thoroughly greased and then given its first and only bath for a year. This ceremony is performed in the family soup kettle over a slow fire while the nurse supports its wobbly head. After several visitors have seen the child it is tightly swathed and swung in a hammock.

From these primitive obstetric methods we see that there is little treatment actually indigenous to the Lapps themselves, but it has come from the Far East, through Russia and Finland, or from the South, long ago. Strangely enough, the modern scientific methods of Scandinavia have not penetrated far into the inland regions of the nomads who are of decidedly inferior mental equipment to their coastal neighbors; but even to the people who live near the coast, or on the borders of the more progressive countries, the Lappish quacks with their charms and mumblings, their magic and pretended inspirations often seem more efficient and trustworthy than men or women who use the methods of the modern graduates of a university.

Although the Lapps seldom complain of pains or aches or fevers they are not long-lived nor are they quite as stolid as they appear to strangers. A new-born baby may be frozen to death in its bed, and elderly men and women have many sorrows, but such events are merely temporarily sobering and are taken as fate. A government doctor is sent among them to note the births and deaths and marriages, but he seldom can help them in any emergency. If, however, the Lapps have any public grief or tragedy or fright, or if one of their friends leaves home to cross the ocean or even to go for a short time away from their own land, the relatives make as wild demonstrations of sorrow as do the hired mourners among the Mohammedans. They all cry and wail in a heart rending way, but it is only the custom of the country.

There are as many unsettled economic questions as medical among these strange relics of an old civilization. Their nomad ways and lack of books make education almost futile, and as their wealth is in their reindeer and dogs, and their wants unlike those of their near neighbors, it is difficult to convince them that any civilization can be better than their own.

Haddam, Conn., Dec. 27, 1935. KATE C. H. MEAD.

The Army Medical Library of Washington
The Largest Medical Library that has ever existed

That our National Medical Library has attained its hundredth year of existence will surprise many of the physicians, teachers and students who make such extensive use of it. The average person with even a smattering of knowledge of the history of our profession in the United States will think of the founder of the Army Medical Library, or Library of the Surgeon General's Office, as it was always called prior to 1922, as Dr. JOHN SHAW BILLINGS. But great as BILLINGS was, and great as was his contribution to the upbuilding of the greatest medical library in the world, he was *not* its founder. The Library came into being two years before BILLINGS's birth.

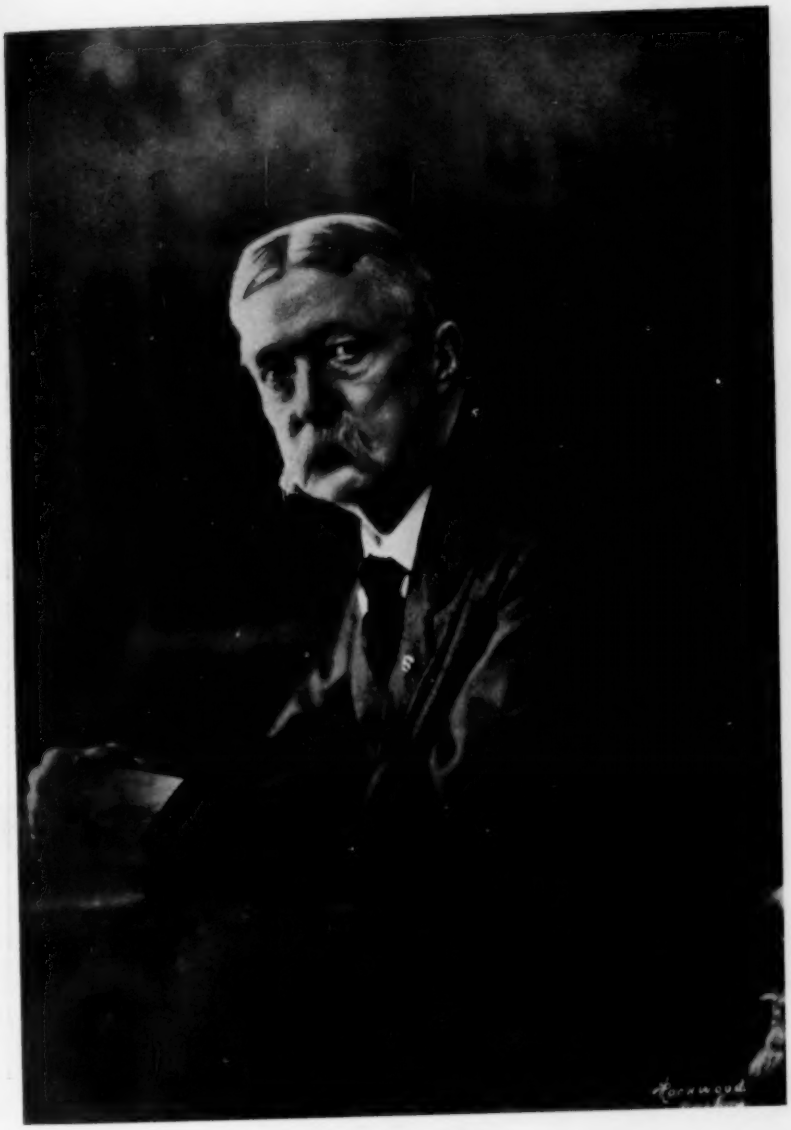
Sometime in the year 1836—we do not know the exact date—the Surgeon General of the United States Army, Dr. JOSEPH LOVELL, established a collection of books in his office, primarily as reference works for himself and his assistants. This was the origin in name as well as in fact of the "Surgeon General's Library." A century ago medical books and journals were not within the reach of the average physician. A few celebrated professors had noteworthy private medical libraries, and some of the medical schools had managed to acquire important collections, but by and large, the American physician found himself cut off from the bulk of medical literature when he completed his studies at medical school. It was just this state of affairs that caused the development of the great medical library in Washington. That the work was done by the Medical Corps of the United States Army is one of the many evidences of the important peace-time activities of that body.

Surgeon General LOVELL's collection of books was a modest

one, and four years after the collection was begun the first catalogue was prepared. It is entitled *A Catalogue of Books in the Library of the Surgeon General's Office Washington City*, 1840. It consists of 23 unnumbered manuscript leaves, and lists 130 titles. The only known copy of this catalogue—possibly the only copy that was ever made—is one of the most precious manuscripts in the Army Medical Library to-day. The first printed catalogue of the Library is dated October 23, 1865, and consists of a 32-page pamphlet listing 2253 volumes (602 titles under eleven topical subdivisions). This little volume placed alongside of the 49 ponderous royal-octavo tomes of the *Index Catalogue*, serves by contrast as an eloquent monument to one of our country's greatest men of science, as we shall see presently.

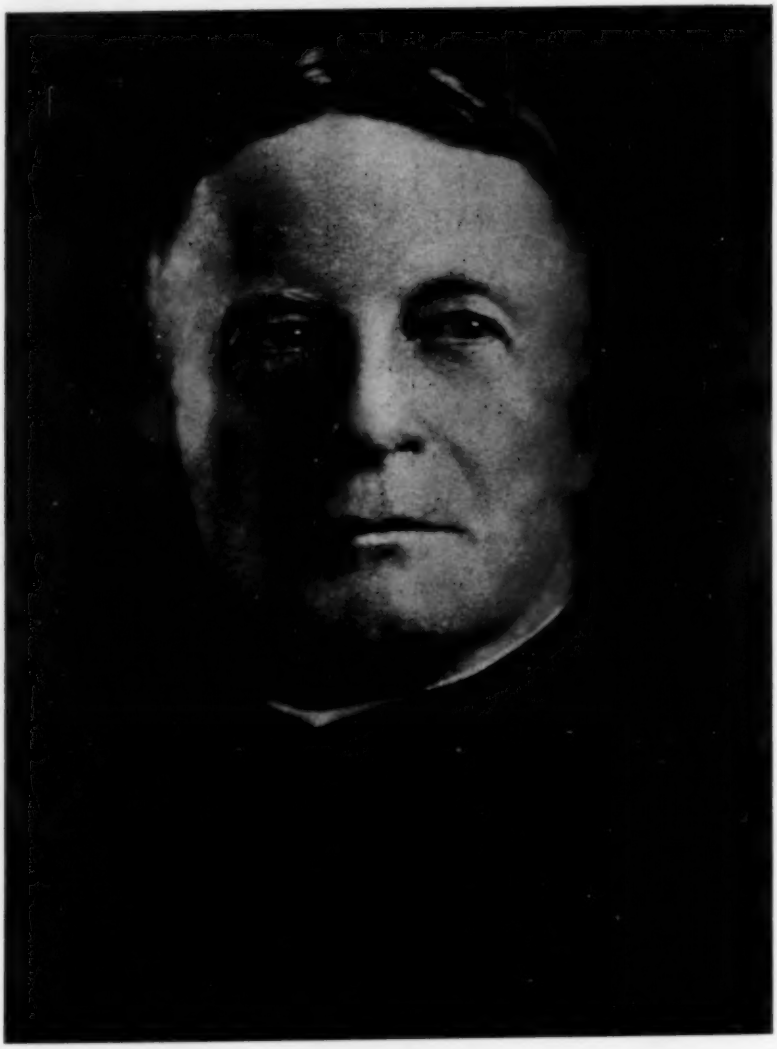
With the close of the War Between the States, a young medical officer of the United States Army who had served in the late war with distinction, winning brevets as captain, major and lieutenant-colonel "for faithful and meritorious services", was given the work of building up the Library of the Surgeon General's Office. It was a congenial duty for a man of the tastes of JOHN SHAW BILLINGS, and the manner in which he performed his task has placed his name among those of America's greatest physicians.

BILLINGS graduated in medicine at the Miami College, now consolidated with the University of Cincinnati. In preparing his graduating thesis he first experienced the difficulty that handicapped every American medical man of that day. He could not find the data he needed. He had to consult many books, and ransacked the public and private facilities of Cincinnati for them. But the other books that he needed, and they were the greater portion, had to be sought in New York, Philadelphia and elsewhere. After some six months of such effort BILLINGS became convinced of three things. First, that enormous labor and time is required to search for medical references, and that such indices as existed were unreliable. Secondly, that there were then in existence "somewhere over 100,000 volumes of medical books and journals, not counting pamphlets and reprints." And thirdly, "that while there was nowhere in the world a library which contained all medical literature, there was not in the United States any fairly good medical library, one in which a student might hope to find a large part of the literature relating to any



JOHN SHAW BILLINGS
(1838-1913)

E. E. HUME



FIELDING H. GARRISON
(1870-1935)

E. E. HUME

medical subject, and that if one wished to do good bibliographical work to verify the references given by European medical writers, or to make reasonably sure that one had before him all that had been seen or done by previous observers or experimenters on a given subject, he must go to Europe and visit, not merely one, but several of the great capital cities in order to accomplish his desire." These words are from BILLINGS's address at the University of Cincinnati thirty years later.

BILLINGS's great opportunity to correct this state of affairs came in 1868 when the farsighted Surgeon General JOSEPH K. BARNES made available to him some $80,000 left over from hospital funds of the late war. BILLINGS began his work with a will, and devoted to it his tremendous energy and ability. The collection grew apace. He published his first catalogue in 1871, some 454 pages with a 26-page supplement. A three-volume catalogue appeared in 1873-4. These forerunners of the great *Index Catalogue* were mere lists and in no wise comparable to the later publication.

The catalogue of 1871 is introduced by the following memorandum :

"That there is need in this country of a medical library of this character is sufficiently evident from the fact that, in all the public medical libraries of the United States put together, it would not be possible to verify, from the original authorities, the references given by the standard English or German authorities, such as HENNEN, REYNOLDS, or VIRCHOW. No complete collection of American medical literature is in existence; and the most complete, if in this country, is in private hands, and not accessible to the public, while every year adds to the difficulty of forming such a collection as the Government should possess."

BILLINGS envisaged something more than a mere list of the books in the library of which he had charge, for "all is not bibliography that pretends to be such." "Books," he said, "are properly compared to tools of which the index is the handle." He contemplated the most mighty piece of bibliography ever undertaken in medical science or in any other field. He considered that the profession of medicine was entitled to a catalogue in which under both authors and subjects the literature of the world could be found. He wanted the ideas of the leaders of scientific thought in every land, so, in 1876, he published a *Specimen Fasciculus*

of a Catalogue of the National Medical Library, under the Direction of the Surgeon-General, United States Army. This he submitted to the medical profession for criticisms and suggestions. Its style and arrangement were practically those of the present *Index Catalogue*, differing only in certain typographical details.

From 1876 on, BILLINGS continued the preparation of the prospective *Index Catalogue*. At length in 1880, partly through the good offices of Dr. ABRAHAM JACOBI, Congress made the appropriation for printing it.

The matter of typography and general arrangement of the contents having been settled in the *Specimen Fasciculus*, the main question was that of classification. "Following the general idea of a subject and author catalogue arranged in dictionary order in a single alphabet, the special subjects were featured by means of key titles or rubrics. After settling upon the main grand divisions, such as *Aneurism*, *Cancer*, *Tumors*, *etc.*, and subdividing these, the subjects of lesser weight fell into their place by the simple device of finding the centers of gravity of the title in each case" (GARRISON). Dr. BILLINGS saw clearly that he could not prepare a complete bibliography of his subject, but rather a bibliographical conspectus of the contents of a great library. Happily this proved so complete that it became, for practical use, a working bibliography of medicine. Modern medical science was even then beginning to advance by leaps and bounds, its surface aspect constantly changing as it advanced, so that he saw at once that it would be impossible to adopt any arbitrary and fixed classification based on a definite scheme of nosology. Any such scheme would have been, like the average medical textbook of to-day, obsolete within a few years.

The appearance of the *Index Catalogue* marked an epoch in the development and improvement of medical literature, particularly in the United States. Editors of medical journals, chiefs of clinics and laboratories, and physicians writing upon all branches of medicine, who formerly had to obtain historical, statistical, and other data in a most haphazard way, now had their materials ready to hand in the most convenient and accessible form possible, that is, the strictly alphabetical. The *Index Catalogue* has no equal. "Its preparation," said OSLER, "is Gargantuan." In no

other field of knowledge is there a work comparable to this, the world's standard of medical bibliography.

BILLINGS used to say : "The *Catalogue* is a tool that must be used for a time before you can judge of its merits." Certainly it has been used to that point. Years ago OSLER told of how worn and bethumbed were the volumes of the *Index Catalogue* in foreign medical libraries, and I have myself seen the same condition recently in a dozen or so countries. The *Catalogue* as a working tool is in constant use in Tokyo, Stockholm, Buenos Aires, and way points. In his Schorstein Memorial Lecture, delivered at the London Hospital on October 17, 1935, Professor WILLIAM BULLOCH, F. R. S., said : "Among catalogues the Surgeon-General's is regarded by the authorities at the British Museum as the greatest ever achieved. It has the great virtue of being a subject index, unlike that of the British Museum, which is a name index only. The story of its construction is not as well known as it ought to be." (*B. M. J.* October 26, 1935.)

The *First Series* of the *Index Catalogue* was completed with Volume 16 in 1895 and BILLINGS voluntarily retired from the Army to become Professor of Hygiene at the University of Pennsylvania. In the following year a *Second Series* was begun under the careful redaction of Dr. ROBERT FLETCHER, BILLINGS's able assistant, who continued this work up to his death in 1912 in his ninetieth year. The *Second Series*, twenty-one volumes, was completed four years later, and from 1918 to 1932 the *Third Series* was published. Volume 1 of the *Fourth Series* has just been completed and Volume II will appear in a few months, thus appropriately marking the centenary of the Army Medical Library.

HOW TO USE THE INDEX CATALOGUE

To find practically everything that has been written on a specific subject, it is merely necessary to look in the alphabetically arranged *Index Catalogue*. For example, in order to find the literature of, say, *fractures of the clavicle*, one simply refers to the *C* volume of the *First Series* of the *Catalogue* where under *Clavicle, Fractures of*, there are listed first the books, then the theses, and finally the articles in the medical journals of the world, all that had been

collected on this topic from the early days down to the date when this particular volume of the *First Series* went to press, 1882. Next, in the *C* volume of the *Second Series*, the material on this subject that was indexed between 1882 and 1898, the date of its printing, would be found. Similarly, in the *C* volume of the *Third Series* the material from 1898 to 1922 would be recorded, 1922 being the date when this volume of the *Catalogue* went to press. For material since 1922 the card index of the Library is available. Moreover, by taking the annual volumes of the *Index Medicus* from 1922 to date, the bulk of the remaining medical literature on our selected topic would be found, though the Army Medical Library indexes considerably more material than does the *Quarterly Cumulative Index Medicus*. How simple, yet how often does the Library receive letters asking how the literature on any subject may be "looked up!"

GARRISON, himself one day to become assistant librarian, told of a conversation with the then holder of that office, Dr. ROBERT FLETCHER. In his whimsical way FLETCHER "likened the *Index Catalogue* to a vast metropolitan hotel containing story after story of rooms and suites of rooms of all sizes and prices, adapted to the tenants of every degree of income and worldly place. In such a caravansary, some subjects like *Labour*, *Surgery*, *Water Supply*, etc., are old wealthy patrons having a permanent claim upon apartments of vast extent, occupying an entire floor. Others, such as *Acupuncture*, *Amulets*, *Animism*, are on such a slender financial footing that must put up with hall bedrooms or be 'cabined, cribbed, confined' in the attic. Others, such as *Arterio-sclerosis*, *Bacteriology*, *Parasitology*, *Pellagra*, *Poliomyelitis*, were once poor and needy, but having come up in the world acquire extensive suites, with rooms perchance for even maid and courier. Others, such as many modern drugs, diagnostic tests, and surgical procedures, are bounders and get-rich-quick parvenus, who exhaust their substance in vain and vulgar show, fading away as soon as their credit is gone." Dr. FLETCHER's picture is still a true one, and the librarian and editor of the *Index Catalogue* must still seek, like mine host of a large hotel, to accommodate the guests in apartments of the proper size and position, though not without a careful eye on the guest's probable ability to pay his reckoning.

BILLINGS once said that a librarian is in one respect only a sort of hodcarrier, "who brings together the bricks made by one set of men in order that another set of men may build therewith—but he is apt to take quite as much pride and satisfaction in the resulting structure, provided it be a good one, as if he built it himself." Thus does he differ, I may add, from the hodcarrier of the ancient Irish story, who felt that all he had to do was to carry the bricks to the top of the wall and the man there would do all the work!

The task of indexing, for the *Catalogue*, the periodical medical literature that is received at the Army Medical Library, is enormous. Even in 1887 BILLINGS was able to say: "I obtain for the Library all the medical journals which are published in the world." The Library now receives about 2000 medical journals and indexes *every* worthwhile article, in *every* issue of *every* journal of almost *every* country and in almost *every* civilized language. Books, theses, pamphlets, documents are similarly indexed. Dr. FLETCHER once exclaimed that the whole world was in conspiracy against medical bibliography. As Professor BULLOCH recently said in England, "Presently the population not actually engaged in writing would be employed in indexing and cataloguing."

The publication of the *Index Catalogue* is an expensive affair, though it is generally admitted that it has been done with the minimum of cost. The thousand copies of each volume cost between eighteen and nineteen thousand dollars merely to print. The work of preparation costs something more than $14,000, so that the cost of each completed copy is about $32 or $33. The Government Printing Office, where the law requires this work, as all Government printing, to be done, has stated repeatedly that the *Index Catalogue* is its most difficult bit of printing. The text is all set by the monotype machine, an efficient but not simple apparatus, in the use of which the operator cannot see what he is writing and cannot at that time correct errors. The general reduction of War Department funds following the depression made it impossible to issue the usual annual volumes of the *Index Catalogue* for 1933, 1934, and 1935. However, after the appearance of the volume now in preparation, two volumes a year are desired until the three missing numbers have been made up.

THE INDEX MEDICUS

In 1879 BILLINGS established another monumental work, the *Index Medicus*, a monthly classified record of the current medical literature of the world. Its editorial management was principally in the hands of Dr. FLETCHER, who may justly be called the "Father of the Index Medicus," just as BILLINGS is the "Father of the Army Medical Library," though neither was in fact the founder.

The *Index Medicus* consisted from the start of a carefully printed monthly fasciculus, giving the medical literature of the preceding month carefully arranged as to subject-rubrics. The classification, as covering a smaller body of material, is more general and less subdivided than that of the *Index Catalogue*, the scheme of nomenclature and nosology being, as the editors stated, essentially that adopted by the Royal College of Physicians of London, "based upon Dr. FARR's well-known system." In the early issues of the *Index Medicus* a special page of medical "Notes and Queries" was included, consisting of questions and answers bearing upon rare books and editions, and other matters of medical bibliography and history. At the end of each volume of twelve numbers, an annual author and subject index of the whole material was prepared, the subject index being minutely subdivided, forming, in respect to classification, a sort of annual *Index Catalogue en miniature*.

Never a Government publication, the *Index Medicus* had hard financial sailing from the start. It was expensive to publish and though of the greatest use, the number of its subscribers was necessarily limited, being chiefly medical libraries. From January 1879 (Volume 1) to April 1899 (Volume XXI) it was published successively in New York, Detroit, Boston, and Washington. Then came the time when its founders could no longer afford to continue it. In vain did OSLER plead before a meeting of the American Medical Association that physicians subscribe *Bibliographia Medica*, under the redaction of MM. CHARLES RICHET and MARCEL BAUDOUIN, was issued in Paris as a replacement for *Index Medicus*, from 1900 to 1902, three volumes having been published. In 1903 the Carnegie Institution of Washington

took over the *Index Medicus* and the second series edited by Drs. FLETCHER and GARRISON ran from 1903 to 1920, eighteen volumes in all. In 1921 the third series began and continued until 1927 when the *Index Medicus* was merged with the Quarterly Cumulative Index (founded 1916) of the American Medical Association. The combined periodical, the *Quarterly Cumulative Index Medicus*, was published under the joint direction of the Army Medical Library and the American Medical Association until December 1931, when its connection with the Library ceased and it became solely a journal of the Association.

In 1914 Professor ADAMI of McGill, writing of the *Index Catalogue* and *Index Medicus*, said : "It is difficult to realize what service those two publications have been to science the world over, or what has been the influence also to medicine the world over, of the existence of the marvelously progressive Library of the Surgeon-General's Office, and its service in bibliographical search... [It is] regarded everywhere as *the* model medical library... I would go so far as to say that the outstanding service to medicine by the United States has been this Library with its publications." *(Bul. Med. Libr. Assn. III, 56.)*

THE LIBRARY BUILDING

Between 1865 and 1883 the Surgeon-General's Library was merely a growing collection of books. In cramped quarters over the old Riggs's Bank at the corner of Fifteenth Street and Pennsylvania Avenue, the Surgeon General and his assistants carried on. Here, among other official business, all new accessions in the way of books, pamphlets, and theses were ticketed and catalogued, after which they were sent to the Library Hall in Ford's Theatre, that melancholy scene of President LINCOLN's assassination, by this time used by the War Department, largely as a storehouse. So small were the quarters over Riggs's Bank that the boxes of books had to be opened in the back yard.

The medical profession of the country was becoming alive to the realization that a very active and far-sighted man in Washington was developing for them a mighty collection of books. A suitable building was essential. On December 17, 1883, President ARTHUR

in a message to Congress recommended the appropriation of $200,000 for such a building, in which to house the Surgeon General's Library and its sister institution, the Army Medical Museum. Among other letters and resolutions urging the appropriation, was one signed by SAMUEL D. GROSS of Philadelphia, AUSTIN FLINT of New York, then President of the American Medical Association, and OLIVER WENDELL HOLMES of Boston, three of the most distinguished physicians of the country, each representative of the medical center in which he lived and worked. The American Medical Association appointed a very active committee to push matters, consisting of AUSTIN FLINT, SAMUEL D. GROSS, DAVID W. YANDELL of Louisville, THOMAS G. RICHARDSON of New Orleans, and H. F. CAMPBELL of Augusta, Georgia. The influence of such men was great and it was felt in Washington.

The money was provided and the building was completed and opened to the public in 1887.

The Library consists of a huge Library hall (120 × 80 feet) containing the main stacks (3 tiers), and tables for readers. A work room of the same size is devoted to the unbound journals and documents, tables for readers, also the extensive statistical collection presented to the Library in 1923 by the Prudential Life Insurance Company. There are in addition work rooms for the staff, offices, storage space, etc. An extensive photographic laboratory is maintained by the Museum.

GROWTH OF THE LIBRARY

BILLINGS added to the Library's collection not only through appropriations. By means of exchanges and gifts and by ransacking such private collections as were generously thrown open to him he obtained many rare desiderata and filled many lacunæ. Dr. OLIVER WENDELL HOLMES humorously described a visit by BILLINGS to his library in Cambridge; how, directly on entering the room, BILLINGS swept the shelves with a keen glance and selected the most valuable book in the collection, looked at it for a moment, put it back on the shelves, took another look around, and easily found the second book in the scale of values.

"Why, sir," said HOLMES, "Dr. BILLINGS is a bibliophile of such eminence that I regard him as a positive danger to the owner of a library, if he is ever let loose in it alone."

For all this the "Autocrat of the Breakfast Table" was one of those who strongly urged Congress to make suitable appropriation for the *Catalogue*. "When we have a noble library like that in Washington," said he, "and a librarian of exceptional qualifications like the gentleman who holds that office, I believe that a liberal appropriation by Congress to carry out a conscientious work for the advancement of sound knowledge and the bettering of human conditions, like that which Dr. BILLINGS has so well begun, would redound greatly to the honor of the nation. It ought to be willing to be at some charge to make its treasures useful to its citizens, and, for its own sake, especially to that class which has charge of health, public and private."

In the early days of the Army Medical Library, books had to be consulted in the reading rooms and could not be loaned outside of the building—except to a few trusted souls to whom BILLINGS extended this privilege. OSLER was one of these, but once he left a rare book on the train from Washington to Baltimore, and it was never recovered. For all that they were the best of friends and remained so to the end, BILLINGS punished OSLER for this loss of PEACOCK's *Malformations of the Heart*, by depriving him for a year of his privilege of taking books from the Library. The professor of medicine of Johns Hopkins had to make many a trip to Washington for books that he could not find in Baltimore or Philadelphia.

At the coronation of King GEORGE V, OSLER was created a baronet, and the Librarian of the Army Medical Library and his staff sent him a letter of congratulations. Here is his reply :

Dear Friends : Among the 1000 telegrams and letters which I received, not one touched my heart more closely than that which you all so kindly sent. Not a little of any success I may have had is due to the enormous stimulus which the publications of your department have had in my work. You are part of the machine that pulls the profession along, and little realize the amount or importance of your labours. I dare say the next

generation will be able to appreciate better what you have done. I can honestly say that no one of this generation has had a more grateful sense of his obligations than

your sincere friend & well wisher,

September 1, 1911. WM. OSLER.

In the following year he said : "Probably few men in the profession owe a deeper debt of gratitude to the Surgeon-General's Library than I."

At the time of Sir WILLIAM's last illness he kept a memorandum pad on his bedside table. On this he would jot down scraps of writing, among them a slip concerning the destination of certain special books. By this memorandum he left books to the British Museum, the Bodleian Library at Oxford, the Library of the Royal College of Physicians, the Faculté de Médecine de Paris, the Royal Society of Medicine, the University of Leyden, the Bibliotheca Lancisiana of Rome, the College of Physicians of Philadelphia, and then there is this note :

"To the Surgeon General's Library, Washington.

So difficult to give anything to a collection so rich; but I thought that perhaps the MS of my farewell address, The Fixed Period, which caused a little excitement, would find its best resting-place in a library to which I owe so much & some of whose members—BILLINGS, FLETCHER & GARRISON have been my intimate friends. It is the typewritten copy and I read it & I have put a note, the printing of which might be deferred a few years." [The note, unfortunately, was not in the volume when it reached the Library.]

In his will, by which he left his own extensive collection of rare medical books to his *alma mater*, McGill University, he specified that one of the curators of the *Bibliotheca Osleriana* should always be the Librarian of the Army Medical Library. Sir WILLIAM's ashes rest behind his bronze bas-relief in the wall at this library which bears his name, at McGill.

The first loans of books for use outside the Library building were made in 1887, but the practice was very limited and usually a deposit was required of the borrower. Acts of Congress in 1892 and 1901 placed the Library at the disposal of the medical profession of the country, under such restrictions as might be found necessary, and it has remained so ever since. New books to the

number of many thousands are loaned to libraries throughout the country, and in Canada, Mexico, and Cuba, by means of an interlibrary loan system. Our largest user during the past year was Yale University, with McGill, Columbia, and Michigan as good runners-up.

BILLINGS used to estimate that about one-thirtieth of the world's literature was medical, and he gave figures to prove it. There is no reason to think that the ratio has changed since BILLINGS's time. If this figure be accepted, it is interesting to compare the size of the collection of the Army Medical Library with the country's largest general collection of books, the Library of Congress, which, incidentally, is now larger than the collection of either the British Museum or the Bibliothèque Nationale, Paris. The report for 1934 shows that the Library of Congress had 4,805,646 volumes. The Army Medical Library, to maintain BILLINGS's ratio, would, have to include not less than 160,188 volumes. As a matter of fact it contains 941,181 volumes or about six times what it would be expected to have to be compared with the Library of Congress. The difference in expenditures is also striking. The Army Medical Library has about nineteen per cent. as many volumes as the Library of Congress, but receives only about nine and one eighth per cent. as large an annual appropriation for purchases.

In BILLINGS's address, the best he ever wrote, delivered in 1881 before the International Medical Congress in London, he said :

"If the entire medical literature of the world, with the exception of that which is collected in the United States, were now to be destroyed, nearly all of it that is valuable could be reproduced without difficulty." The importance of the Army Medical Library, then in its infancy, could hardly have been better expressed.

RARE MEDICAL BOOKS

Of rare medical books, the Army Medical Library has a magnificent collection. Some six hundred medical incunabula are known, and of this number the Army Medical Library has no less than four hundred and fifty, the largest number to be found in any library in the New World, and a collection that stands comparison with that of any library in the Old World. Of some

works the Army Medical Library has the only known copy, and of rare books published after 1500 the collection is one of the best. The same is true of early medical manuscripts, of which the Library possesses one hundred and fifty.

The oldest publication possessed by the Army Medical Library is JOHANNES GERSON's *De pollutione nocturna*, printed in Cologne about 1467, the only copy in the United States. Another very old book, though less rare as there are other copies in this country, is *Speculum humanæ vitæ* by RODERICUS ZAMORENSIS, printed in Rome in 1468.

Among early writings on plague, the Library has VALESCUS DE TARANTA's *De epidemia*, Basel, *circa* 1470, and ALCANIS LUIS's *Regimen pestilentiæ*, printed at Valencia about 1490. The Library has also a perfect copy of the first printed book on pediatrics, BAGELLARDO's *De infantium ægritudinibus*, Padua, 1472, a sort of compendium of practice of the time in which it was written. The only other copy in America is in the Pierpont Morgan collection.

Many of these incunabula are first editions. *De medicinis universalibus* by the Arabian physician MESUE THE YOUNGER, printed in Venice in 1471, is the first purely medical book ever printed in the world. Another Arabian physician, ABULQASIM, is represented by a very rare issue of his *Liber servitoris*, printed in the same place and year. Both authors were very famous during the Middle Ages, and their works served as texts for medical students. Both volumes are the only known copies in the United States. In America, IBN SINA's *Canon*, printed in Padua in 1479, is found only in the Army Medical Library. Our Latin GALEN, published by PINZIUS in Venice in 1490, is also a first edition, and, though it is an incomplete copy, it is often photographed on account of its rarity.

Of the very early publications on the "mala de Franzos," the Library possesses JOSEPH GRUENPECK's Latin Treatise, *De pestilentiali scorra*, first published in 1496, a work of great contemporary popularity. This edition, printed in Cologne, is exceedingly rare, copies being known in but five other libraries of the world, Munich, Hamburg, Copenhagen, London, and Philadelphia. TORRELLA's two works on syphilis, both very great rarities, are in the Library. The earlier of the two, *Tractatus cum consiliis*

contra pudendagram, of 1497, is undoubtedly, says SUDHOFF, the most valuable of the early works on this disease. There are only three other copies in the world, one being incomplete. The later work, printed in Rome in 1500, *Dialogus de dolore*, etc., is likewise very rare and mostly known in its reprints.

Some of the early works are represented in the Army Medical Library by several successive editions. Thus the Library has seven editions of SALICETO's surgery, eight editions of HENRICUS DE SAXONIA's popular work, *On the Secrets of Women*, formerly attributed to ALBERTUS MAGNUS, and eight editions of the *Regimen sanitatis* of TADDEO OF FLORENCE.

These books are mainly of the sort which are now very difficult to acquire. They are not all equally important, but taken as a whole the collection is admirably and concisely representative not only of early medical knowledge, but also of fifteenth century typography.

Space does not permit even a hasty consideration of the other treasures of the Library. It contains, for example, a more complete file of French theses than the Library of the Medical Faculty of Paris. Its collection of authors' presentation copies of important works shows the autographs of such figures as Lord LISTER, PETTENKOFER, PASTEUR, EHRLICH, VIRCHOW, CONHEIM, PAGET, KOCH, to mention a few of the Europeans who have lived but recently.

ARMY MEDICAL LIBRARY
BECOMES THE NATION'S LARGEST SPECIAL LIBRARY

When the Army Medical Library was but twenty years old, counting from the time of its expansion under BILLINGS, it contained more medical literature than either the library of the British Museum or the Bibliothèque Nationale of France. "This is very largely due," said BILLINGS in 1883, "to the fact that while the Washington Library is the national collection, it has been kept separate from the general National Library. The result of this has been that the medical profession has taken much more interest in it than they would do if, as in the case of the English and French medical collections, it became merely a

section of the National Library. As a matter of fact comparatively little use is made by medical writers of the collection in the British Museum or the Bibliothèque Nationale. They consult in preference the special medical libraries in London and Paris, which are under the direction of medical bibliographers." That the same conditions prevail in Europe to day has been told me by librarians and medical men in those very cities. It is a recognized fact that a highly specialized library invariably suffers when merged in a general library, no matter what attempts are made to keep the specialized collection as an entity.

In America we have before us for comparison, the development of the two largest professional libraries in the country, those of law and of medicine. The Law Library of Congress was established in 1832, the Act of Congress requiring this collection to be maintained as a separate unit in "an apartment near the Library of Congress." The collection has been housed in various places, at present being in one of the wings of the Library of Congress building. The Law Library has frequently been neglected for it has but little money spent on it, its growth being largely due to copyright, transfers from other government libraries, and international exchange. Several law libraries in the United States are superior to the Law Library of Congress in some fields and the Harvard Law Library is far larger and superior in every way, containing 435,000 volumes while the Law Library of Congress contains but 275,000 (the totals are those of 1933). Contrast this with the growth of the Army Medical Library, which in twenty years passed the medical collections of the two largest general libraries in Europe as well as those in America.

The Law Librarian of Congress in 1933 wrote: "Undoubtedly, had the Law Library been independent from its foundation in 1832, the government would have possessed the best law library in the world today, instead of it lagging behind, with many serious gaps in the collection." Yet the Law Library of Congress was established a generation before the Army Medical Library. In a circular letter sent to prospective members of the *Friends of the Law Library of Congress*, it was proposed to "crystalize sentiment throughout the country to the end that the national law library may obtain all the resources necessary to meet the demand made upon it, *and become as eminent in law as the*

Surgeon-General's Library in Washington is in medicine" (italics mine).

The difficulties of the Law Library of Congress, as so well set forth by my friend, Dr. JOHN VANCE, the librarian, show what any specialized library experiences when merged in a general library. The situation is well understood by the Librarian of Congress, Dr. HERBERT PUTNAM, who on September 18, 1929, wrote, that he felt that the Army Medical Library should be kept as a unit, being in a specialized field of subject matter. "Even though consolidated with some other library, say a general library like the Library of Congress, it would still require a specialized staff," and should "be administered by those familiar with that field." "The Army Medical Library," continued Dr. PUTNAM, "is one of the various specialized collections, for instance, that of the Department of Agriculture, that of the Geological Survey, that of the Bureau of Education—which form units outside of the Library of Congress, but which in intimate association and coöperation with the Library of Congress, form the National Library of the United States."

Despite all this there have occasionally been ill-advised attempts to merge the Army Medical Library with the Library of Congress. The medical profession of the country has invariably opposed such projects with the utmost vigor. In 1914, for example, a paragraph of an appropriation bill in Congress provided for such a consolidation, though Surgeon General GORGAS was not even consulted before the measure was introduced. The American Medical Association at once raised an outcry against the move. "The Library of the Surgeon-General's Office," ran the editorial in the *Journal of the American Medical Association*, "has for many years been the pride of the medical profession of the Unites States," and there were gracious words about the Army's having administered the national medical library over many years at a minimum of expense and a maximum of service. "This hastily considered and unwise effort to pitchfork the Surgeon-General's Library into the Library of Congress is entirely without justification or reason; it can only result in obliterating the identity of the Surgeon-General's Library and destroying its usefulness," and it went on to tell why. "To fulfill the functions which it has developed, the Surgeon-General's Library must maintain

its autonomy. Its record is such as to entitle it to the confidence of Congress." Fortunately the measure did not pass. It was but hastily considered, being what is known as a "rider", one of the irrelevant amendments saddled on an appropriation bill. The matter was reconsidered and in a speech on January 22, 1915, Congressman LLOYD of Missouri carried out the wishes of the profession in his and other states, and urged the maintenance of the Army Medical Library as an independent collection. "It is," he said, "performing splendid duty in furnishing information that could not well be secured elsewhere, to the medical fraternity of the United States."

THE LIBRARIANS

BILLINGS would have been a famous man even if he had never become America's greatest bibliographer. He was uniformly successful. While hard at work on the Library and its *Index Catalogue*—"BILLINGS' float through posterity", as OSLER called it—JOHNS HOPKINS of Baltimore died, leaving his fortune to found the university and hospital which bear his name. The trustees asked five experts in hospital construction to submit sketch plans for the construction, heating, ventilation, and administration of the proposed group of hospital buildings. The plans of BILLINGS were accepted, the architects' plan adapted to them, and BILLINGS, with the consent of the Surgeon-General, appointed medical adviser to the trustees. The series of reports on hospital construction that he prepared in this capacity have become classical. It was he who selected first WILLIAM H. WELCH, whom he met as a student in Germany, and next WILLIAM OSLER showing that he, like President GILMAN, had the power of judging not merely performance but also promise in younger men.

His studies in vital statistics led to his being put in charge of the vital and social statistics of the Tenth and Eleventh Censuses of the United States, and his analysis and report had much to do with the transformation of the old Marine Hospital Service to the splendid modern United States Public Health Service. His place in the world of public health resulted in his being appointed to the chair of Hygiene at the University of Pennsylvania,

and after the completion of the *First Series* of the *Index Catalogue*, [1895], he voluntarily retired from the military service to accept it. He had not been made Surgeon-General though his distinguished career might have entitled him to that preferment. Finally he was given charge of the consolidation of the three public libraries in New York City and the cataloguing of each, becoming when the present building was completed, its librarian. During his last years he was active in the organization and guidance of the Carnegie Institution at Washington.

Like PASTEUR, he had the good fortune to be recognized in his lifetime. Memberships in the world's leading learned societies and academies were his (e. g., National Academy of Sciences, American Philosophical Society, American Academy of Arts and Sciences, Royal College of Physicians, etc.), and honorary degrees were conferred on him by the Universities of Edinburgh, Harvard, Budapest, Johns Hopkins, Yale, Munich, Dublin, and Oxford. His fine portrait by Miss CECILIA BEAUX shows him in his Army uniform over which is thrown the gown of a Doctor of Civil Laws of Oxford. The portrait bears the legend : *Presented by* 260 *Physicians of America and Great Britain.*

GARRISON had this to say of BILLINGS's successors as librarians, a statement that I feel free to quote since it was written (1915) long before my connection with the institution :

"The official management and administration of the great library, the selection and purchase of its books, the selection of material for indexing, the enlargement and improvement of its resources, passed into the hands of the Army medical officers who succeeded Billings. As the cantors of the Thomasschule at Leipzig, the successors of BACH, had to be men learned in counterpoint, worthy followers of the great seventeenth century music master, so these Army surgeons have been men specially selected for their scientific and literary attainments. HUNTINGTON, one of the collaborators of the *Medical and Surgical History of the War of the Rebellion*; MERRILL, distinguished by his work in ornithology; WALTER REED, a pupil of WELCH and discoverer of the causal nexus and mode of transmission of yellow fever; and WALTER D. MCCAW, who specialized in tropical medicine and added greatly to the unique historical collections of the Library, have all been imbued with the spirit of enthusiasm and

the interest in the literary side of medicine which BILLINGS brought into his work."

Major WALTER REED, when he became Librarian in 1902, said that he had at length been given the assignment that he had most desired since entering the military service. He held it but a few weeks, however, for his untimely death cut off the career of the best known medical officer that America has produced.

I might add a few words as to the later librarians as regards their other achievements. Brigadier-General CALVIN DEWITT, father of Brigadier-General WALLACE DEWITT, Commandant of the Army Medical Center, was instructor at the General Staff School and later President of the Army Medical School, having served in three wars. Brigadier-General MCCAW became Chief Surgeon of the American Expeditionary Force in France during the World War and was later Commandant of the Army Medical School. Colonel MCCULLOCH was well known as a sanitarian and continued this work with distinction after his retirement from the Army. Brigadier-General WINTER had been in charge of the affairs of the Medical Department of the Army in England during the World War. Colonel STRAUB was one of the leading spirits in the training of officers and men in his department. He won the Medal of Honor for extreme gallantry in action in the Philippines. Major-General NOBLE, the able assistant of General GORGAS in Panama and elsewhere, had had charge of the personnel division of the Surgeon-General's Office during the greater part of the World War, a most difficult task. Colonel PHALEN had been a division surgeon in France and after the War pursued the command and staff instruction such as is followed by officers of the line. Colonel ASHBURN, author of the excellent *History of the Medical Department, U. S. Army*, and many works on hygiene, had been in charge of the Medical Department School in France, and later of the Medical Field Service School in the United States and Professor of Hygiene at the United States Military Academy, West Point. (1)

(1) The following is the complete list of Librarians, with the dates of their service :

1. Colonel JOHN SHAW BILLINGS of Indiana, 1868-1895.
2. Colonel DAVID LOW HUNTINGTON of Massachusetts, 1896-1897.
3. Surgeon JAMES CUSHING MERRILL of Massachusetts, 1898-1902.

BILLINGS had two eminent assistants who, though neither ever became Librarian, brought great honor to the institution in which they made their careers as bibliographers and medical historians. The first was Dr. ROBERT FLETCHER (1823-1912), already mentioned as the Father of the *Index Medicus*. A native of Bristol, England, he came to the United States in 1847 and practiced his profession in Cincinnati until the outbreak of the War Between the States. He served therein as a Surgeon of the First Ohio Volunteers, receiving brevets as lieutenant-colonel and colonel "for faithful and meritorious service". From 1876 on he was associated with the Army Medical Library. His *magnum opus*, the *Index Medicus*, brought him unusual recognition from the Royal College of Surgeons of England. In 1910 he was awarded the Honorary Medal, a prize that had been given but eleven times in the century, the other recipients being PARKINSON, SWAN, BENNETT, CROWTHER, PEACOCK, OWEN, WILSON, PAGET, LISTER, and CHARLES. BILLINGS's other pupil was a young man who in 1891, the year following his graduation in arts at Johns Hopkins, entered the Library as an assistant. He was FIELDING HUDSON GARRISON (1870-1935). Those were the days when it was possible to study medicine in the evening after having devoted the day to other work, and this youth of twenty-one so spent his time. His work at night earned his M. D. at Georgetown University in 1893, but what he learned during office hours from BILLINGS and FLETCHER was probably of yet greater value to him. "Endowed with a keen intellect, a remarkable memory, tremendous industry, and methodical habits, FIELDING H. GARRISON became a man of encyclopaedic learning," says Colonel ASHBURN. He is best known for his *History of Medicine* (4 editions), but his work in medical bibliography was

4. Major WALTER REED of Virginia, 1902.
5. Brigadier-General CALVIN DEWITT of Pennsylvania, 1903.
6. Brigadier-General WALTER DREW MCCAW of Virginia, 1903-1913.
7. Colonel CHAMPE CARTER MCCULLOCH, Jr., of Texas, 1913-1918.
8. Brigadier-General FRANCIS ANDERSON WINTER of Louisiana, 1918-1919.
9. Colonel PAUL FREDERICK STRAUB of Iowa, 1919.
10. Major-General ROBERT ERNEST NOBLE of Alabama, 1919-1924.
11. Colonel JAMES MATTHEW PHALEN of Illinois, 1924-1927.
12. Colonel PERCY MOREAU ASHBURN of Ohio, 1927-1932.
13. Major EDGAR ERSKINE HUME of Kentucky, since 1932.

no less important. He enrolled in the first Plattsburgh Camp and when the United States entered the World War he was commissioned a Major in the Medical Corps, continuing his work at the Library. He was retired from active service as a Colonel in 1930, after nearly forty years of service at the Army Medical Library, and thereafter until his untimely death in 1935 was librarian of the Welch Medical Library of the Johns Hopkins University, a position which Dr. WELCH asked him to fill. Those who have read his erudite papers, which numbered about two hundred, need not be told of the charm and skill of his writing. His monthly editorials written for the New York Academy of Medicine brought forth the highest praise. Yale awarded GARRISON the Litt. D. in 1932. GARRISON's connection with the medical library of the Johns Hopkins University was but another link between that institution and the Army Medical Library. Indeed the Army Medical Library has always been an intimate associate of the Medical School of Johns Hopkins. As OSLER said in his essay on *The Collecting of a Library*, speaking of the medical library of the University, "The Surgeon-General's Library was so near that it did not seem worth while to spend much on old books."

NEED FOR A NEW LIBRARY BUILDING

Libraries, particularly rapidly expanding ones, have a way of outgrowing their quarters, if there are no facilities for expansion. This has happened to the Army Medical Library during the half century that it has occupied the well-known red brick building next to the old National Museum in Washington. The stacks are so full that the engineers have directed that no increase in weight be permitted. Thus books have to be withdrawn when others are added. The overflow now crowds the basement, and indeed every nook and corner in the building. That a new building must be provided is obvious. Moreover, as the present building has been marked for demolition, as a part of the general plans for the public parks of the National Capital, another site must be used.

In 1917 a lengthy report to the 65th Congress on the public buildings of the District of Columbia showed the proposed site

of a new building on the south side of the Mall between 4½ and 6th Streets. A building with some 173,000 square feet of space was contemplated. A large oil painting of the proposed building was made by Lieutenant M. L. BOWER and this may yet be seen in the Surgeon-General's Office—but the building never got nearer completion than the hopes of the medical profession and the imagination of the artist.

In 1919 Congress took the first step in the solution of the problem by purchasing a site adjacent to the Army Medical School at the Army Medical Center. Here, not far from the Walter Reed General Hospital, ground awaits the building. This should prove a most satisfactory place for a great library. The situation is sufficiently near the heart of the city to be easily accessible. There is ample space for expansion and for the parking of automobiles—no small matter in a city like Washington where there is one automobile for each four inhabitants. The Army Medical Center, the American counterpart of the French center at the Val-de-Grâce, will be the more efficient by having the great medical institutions of the Army near each other : the Army Medical, Dental and Veterinary Schools, the Walter Reed General Hospital, the Army Medical Museum, and the Army Medical Library. Such administrative matters as central heating, keeping the buildings open at night, police, etc., would be simplified.

It has been suggested that the site is too far from the center of the city. This can hardly be true for no two places in the District of Columbia are very far apart, since the District is but ten miles square. The Army Medical Center is ten minutes or so by automobile (and there are also bus and street car facilities) from the center of the city, and the present location itself is a long distance from the middle of town.

The Library, in its overcrowded state, has no space for study rooms for the use of special students, but nevertheless some of the readers spend their entire time at work there. For example, certain publishing houses keep a number of employees constantly in the Library doing bibliographical research, abstracting, and translating. Not a few of the text-books in general use have been written or revised almost wholly in the Army Medical Library, though frequently nothing is said of this in the prefaces.

When the present Library and Museum building was built

half a century ago, there was little provision made for expansion of the book stacks. It was the way libraries were built in that day, and many another library of the period later found that there should be consideration given to the time which must come to every progressive library, when the original book space will become inadequate. So the point of saturation has about been reached in the present building. The plans for the new one are so drawn that the stacks can be indefinitely enlarged. At its 34th annual session, the American Medical Association on June 5-8, 1883, passed resolutions urging Congress to provide a suitable building for the two institutions (Library and Museum) "of national importance", the "destruction of which would be an irreparable loss, not only to the United States, but to the world." The resolutions likewise urged the annual appropriations necessary for the upkeep of the collection and the publication of the *Index Catalogue*. These resolutions, with other similar evidences of the Library's position among men of science, were transmitted by the Secretary of War, Mr. ROBERT TODD LINCOLN, to the President, and were incorporated in his message to Congress.

The feelings of the American Medical Association about the need for a new building for the Army Medical Library are in 1936 somewhat what they were in 1883. An adequate building for a library that is the servant, directly as well as indirectly, of every physician in the country, is essential, for the work of the institution *must* go on.

"For the teacher and the worker a great library such as this is indispensable. They must know the world's best work and know it at once. They mint and make current coin the ore so widely scattered in journals, transactions and monographs... The unique opportunities of the Surgeon-General's Library have done much to give to American medicine a thoroughly eclectic character."—Sir WILLIAM OSLER, Bt., *Books and Men*, p. 220. The Army Medical Library is one of the world's foremost scientific institutions. Its *Index Catalogue*, than which no scientific publication ever issued in America has been of greater importance, has been called by such men as VIRCHOW in Germany and WELCH in America, "America's Greatest Contribution to Medicine" (2).

(2) Dr. WILLIAM H. WELCH shortly before his death paid a visit to the Library.

A collection of medical books that is larger and more important than any other that has ever been collected by man, is worthy of suitable quarters. The present building, long since outgrown, must be replaced and surely there could be no better way in which to benefit the entire medical profession of the United States, and at the same time create a lasting monument to the initiative and vision of one its greatest members.

Lieutenant Colonel EDGAR ERSKINE HUME.

Washington, D. C.

He was one of the Library's most earnest readers and on many and many an occasion his advice had been of the utmost help. As he sat in the Librarian's office smoking one of his black cigars, he fell into one of those reminiscent moods which his friends so enjoyed. He spoke of the foundation of this Library, of its growth, of the place it had made for itself in the world of medical science, and then said :

I have been asked on more than one occasion what have been the really great contributions of this country to medical knowledge. I have given the subject some thought and think that four should be named :

1. The discovery of anaesthesia.

2. The discovery of insect transmission of disease.

3. The development of the modern public health laboratory, in all that the term implies.

4. The Army Medical Library and its Index Catalogue, and [he added slowly] this library and its catalogue are the most important of the four.

Dr. WELCH was not one to speak lightly or without due thought. The Librarian was so struck with this pronouncement that he reduced it to writing immediately after the doctor had left. This was not Dr. WELCH's first statement of this kind. In 1921 he had written :

I question whether America has made any larger contribution to medicine than in building up and developing the Surgeon-General's Library and in the publication of the *Index Catalogue* and the *Index Medicus*.

Notes and Correspondence

Second answer to query no. 46.—The following remarks may be added to Dr. GANDZ's answer:

The view is expressed in the Talmud, *Baba Bathra* 25*a*, *b* that the Shekhinah, or Divine grace, rests in the direction of West. See MAIMONIDES, *Moreh* III, 45 and MOSES ISSERLES (1520-1573, chief Rabbi of Cracow) *Torath ha-Olah* I, 4 for explanations why ABRAHAM first selected the West.

JOSEPH KARO (1488-1575) in his commentary *Bet Joseph* on *Ṭur Oraḥ Ḥayim* of JACOB BEN ASHER, section 240 quotes the interpretation of JONA GERONDI (13th cent.); the reason for sleeping head North and feet South is: the candlestick faced the South and the table, the North (see *Exodus* XL, 22, 24). The table symbolized wealth and the candlestick Torah. Therefore, before cohabitation one should pray that his sons be learned in Torah and possess wealth. (Compare the statement in *Baba Bathra* 25*b*: Rabbi ISAAC says: One who wishes to be wise let him face South in prayer, and North if he wishes to be wealthy).

The author of the Holy Epistle (ascribed to MOSES NAḤMANIDES, 1194-1270) chapter III, tells us that the opinions of Rabbi HAMA, and Rab NAḤMAN are not to be taken literally, but are to be understood in a cabalistic sense.

The Zohar section *Bemidbar* (page 238, ed. Wilna, 1894) repeats the view of the Talmud but says head East and feet West. JOEL SERKIS (died 1640, chief Rabbi of Cracow) accepts this opinion in his commentary *Baith Ḥadash* on *Ṭur Oraḥ Ḥayim*, section 3. MENAḤEM AZARYA of Fano (16th cent.) in his responsa No. 3 defends the view of the Zohar as against RASHI and tosafot. He bases his opinion inter alia on the statement in the Talmud, *Sanhedrin* 38*b*: The soil of Palestine supplied the material for ADAM's head; that of Babylon for his trunk; that of Arka de-Agma for his privates; that of all other countries for his extremities. (See GRÜNBAUM, *Neue Beiträge*, 55-58, 62 for Christian and Arabic parallels...)

JACOB EMDEN (1697-1776) likewise supports the Zohar in his responsa I, No. 47 and states that his father (the famous ZEVI ASCHKENAZI,

CONRAD WITZ
The miraculous draught of fishes (Geneva 1444)

1658-1718) so placed his bed. He gives a curious cabalistic interpretation which need not be quoted here.

Several authorities maintain that the custom is not obligatory but optional.

(*New Haven, Conn.*) PHILIP GROSSMAN.

Answer to Query no. 56.—Nardi or Kircher (*Isis* 24, 430-1, 1 fig., 1936). Query 56 sent in by Dr. A. POGO was reprinted in the *Chronique d'Egypte* (XI, 484-5, 1936) where it elicited the following answer :

" M. BERENSON, notre membre protecteur, a eu l'amabilité de faire une recherche à la bibliothèque nationale de Florence. Il nous apprend que la planche de KIRCHER se trouve dans l'ouvrage : *Titi Lucretii Cari De rerum natura libri sex.* Una cum paraphrastica explanatione et animadversionibus D. JOANNIS NARDII Florentini, Florentiae, typis AMATORIS MASSAE FOROLIVIEN, 1647. Aux pages 632 à 641 se trouvent en appendice des ' Adnotationes in praenarrata funera Aegyptiorum ' suivies de huit planches. La VIII[e] est reproduite exactement par KIRCHER. Il résulte des explications de NARDI que celui-ci n'avait pas reconnu les fragments de clepsydres. Cela répond entièrement aux questions posées." (JEAN CAPART.)

Query no. 65. — *The earliest representations of the remains of prehistoric pile-dwellings, apropos of* CONRAD WITZ'S *painting of* 1444. L. BLONDEL'S article "Relevés des stations lacustres de Genève" in *Genava, Bulletin du Musée d'art et d'histoire* (vol. 1, 88-112, 1923) contains a historical chapter "Mentions historiques des stations lacustres de Genève" (p. 89-97), which is especially interesting. The earliest historical monument mentioned by BLONDEL is the painting by CONRAD WITZ (c. 1400-c.1447) which we reproduce. The "Miraculous draught of fishes," is magnificent—the greatest treasure of the museum of Geneva — and it is invaluable as a representation of the Genevan landscape, exactly dated. Indeed it was completed at Geneva in 1444, probably for the cathedral of St. Peter, upon the order of Cardinal FRANÇOIS DE MIES, bishop of Geneva from 1426 to his death in 1444.

This is in all probability the first reproduction of the remains of prehistoric pile-dwellings, the very ones which could be observed in Geneva about the year 1444. Says BLONDEL (p. 89) :

> Le premier document historique où l'on peut reconnaître des pilotis lacustres se voit sur la peinture du retable de CONRAD WITZ, la pêche miraculeuse, représentée dans le port de Genève, et datant de 1444. Nous y distinguons, sans aucun doute possible, la ligne des «fiches»... Ces pilotis sont indiqués émergeant de l'eau,

il faut supposer, soit qu'on pouvait les apercevoir ainsi aux basses eaux, qui étaient très accentuées avant la construction de la première digue de 1708, soit que, par une fantaisie d'artiste, WITZ les ait peints ainsi, bien qu'ils fussent ordinairement immergés. La scrupuleuse représentation des exploitations de terre glaise pour les tuileries, au premier plan, sous l'eau, la fidélité des détails du paysage, comme les pierres du Niton, ainsi que l'étendue des plages, nous engagent à penser que la première explication est seule plausible. Du reste, cette lignée de pieux est indiquée comme partiellement détruite ou rongée et ne pouvait convenir à des palissades en usage pour les pêcheries.

The next Genevese document on the subject is a note in the town's archives dated February 12, 1684. The beginning of lake-dwelling (or pile-dwelling, lacustrine) archaeology by FERDINAND KELLER dates only from the winter of 1853-54 (see *Isis* 22, 308-11, portrait).

There are many literary references to lake-dwellings, the two earliest of which where already pointed out in my *Introduction* (vol. 1, 105) : HIPPOCRATES and HERODOTOS. I take this opportunity for quoting them *in extenso*.

HIPPOCRATES in *Airs, waters and places* (chapter XV, p. 113 in vol. I of W. H. S. JONES edition in the Loeb library). "Now let me turn to the dwellers on the Phasis (river in Colchis, East end of the Black Sea). Their land is marshy, hot, wet, and wooded; copious violent rains fall there during every season. The inhabitants live in the marshes, and their dwellings are of wood and reeds, built in the water. They make little use of walking in the city and the harbour, but sail up and down in dug-outs made from a single log, for canals are numerous."

HERODOTOS, *History* (Book V, chapter 16, GEORGE RAWLINSON'S version). ..."they likewise who inhabited Lake Prasias (in Macedonia), were not conquered by MEGABAZUS. He sought indeed to subdue the dwellers upon the lake, but could not effect his purpose. Their manner of living is the following. Platforms supported upon tall piles stand in the middle of the lake, which are approached from the land by a single narrow bridge. At the first, the piles which bear up the platforms were fixed in their places by the whole body of the citizens, but since that time the custom which has prevailed about fixing them is this : — they are brought from a hill called Orbêlus, and every man drives in three for each wife that he marries. Now the men have all many wives apiece; and this is the way in which they live. Each has his own hut, wherein he dwells, upon one of the platforms, and each has also a trap-door giving access to the lake beneath; and their wont is to tie their baby children by the foot with a string, to save them from rolling into the water. They feed their horses and their other beasts upon fish, which abound in the lake to such a degree that a man has only to open his trap-door and to let down a basket by a rope into the water, and then to wait a very short time, when he draws it up quite full of them."

There are probably other such references in classical and medieval literature, but these two are most remarkable, especially that of HERODOTOS, whose informations have been repeatedly vindicated by modern investigators.

To return to WITZ's painting, are there other graphical documents of that time, or of a previous one, relative to prehistoric pile-dwellings? The purpose of my question is to elicit their existence if they exist, but I doubt it.

Les Terrasses, Nyon. GEORGE SARTON
June 29, 1936.

Query no. 66. — JOHN FREIND (1675-1728). Being engaged in a study of Dr. FREIND's life and works I would be grateful for information concerning letters or autographs of him in public or private libraries.

4518 *Beach 45th St.* PHILIP SHORR
Brooklyn, New York.

Query no. 67. — EDWARD TYSON (1650-1708). Professor M. F. ASHLEY-MONTAGU is engaged upon a study of the life and works of EDWARD TYSON, M.D., F. R. S., Physician and Comparative Anatomist, and being anxious to produce as complete a study as possible of TYSON he would greatly appreciate information of any kind whatsoever relating to TYSON. Please address him c/o New York University, New York City.

Query no. 68.—A seventeenth century Malay dictionary.

The great naturalist RUMPHIUS " Plinius Indicus " (1628-1702)—about whom see my article to appear in *Isis* (vol. 27, 1937)—did not simply create the earliest natural history of the Moluccas, if not of the Tropics, but his prodigious activity extended to human history as well and even to philology. According to his own testimony in a letter addressed to CAMPHUYS, Governor general of the Dutch East India Company, dated June 29, 1695, he had compiled a Malay dictionary for his own usage and written the manuscript of it in his own hand down to the word *pandas*, the rest being written by another hand. Here is his statement:

" Ick verstae dat Meester CHRISTIAEN GERAERTS een Maleyts Woordenboek op Batavia op de Gouwedieſs passar opgekogt heeft en tegenwoordig onder UEdelheyt berust, welcke na alle omstandigheden sal zyn, myn Maleyts Lecsicon (sic) wenste dierhalven het wederom te hebben, als zynde niet gemaekt om publieck te vertoonen, maer tot myn speculatie. Het is met myn eygen handen voor 25 jaren door my geschreven van het begin tot het woort Pandas in de letter P., en het volgende is (van) een andere hand."

That MS. has disappeared. May be it exists in some western or oriental library? The search would not be difficult, as similar MSS. are not likely to be very numerous in any library.

My source of information is the folio volume published in RUMPHIUS' honor to celebrate the second centenary of his death, *Rumphius Gedenkboek*, 1702-1902 (Haarlem 1902, p. 168). GEORGE SARTON.

Answer to Query no. 68.

This query having been communicated privately to the Malay specialist Dr. C. OTTO BLAGDEN, he kindly made inquiries, the results of which are rather discouraging. Says he (letter of October 6, 1936): "With further reference to your letter of the 16th Sept. regarding RUMPHIUS MS. Malay dictionary, my Dutch colleague PH. S. VAN RONKEL replies that he canot give any information; nor do the Dutch bibliographical works either, he says, on the matter. It is to be feared, therefore, that the work is definitely lost, unless after CAMPHUYS' time it found its way somewhere where it still lies hidden."

IV^e Congrès international d'histoire des sciences à Prague en 1937.

Première circulaire

En se basant sur la décision du Conseil des Ministres de la République tchécoslovaque du 10 septembre 1934 et sur la décision de l'Académie international d'histoire des sciences, à Coimbra, le 2 octobre 1934, le groupe international tchécoslovaque de l'Académie internationale d'histoire des sciences se permet de vous inviter au IV^e Congrès international pour l'histoire des sciences réales, qui aura lieu du 22 au 27 septembre 1937 à Prague.

Simultanément sera tenue à Prague, la IV^e session annuelle de l'Académie internationale d'histoire des sciences.

Cette Académie a résolu que l'activité du Congrès se portera sur les matières suivantes :

1° Développement des sciences au XVIII^e siècle et dans la première moitié du XIX^e siècle.

2° Histoire des sciences dans l'enseignement.

3° Thèmes libres.

Se tiendront des sessions plénières et des sessions des sections suivantes : *a*) Section pour les sciences exactes, *b*) Section pour les sciences naturelles, *c*) Section pour la médecine, *d*) Section pour les sciences agronomiques, *e*) Section pour les sciences techniques, y inclus les sciences techniques militaires.

Les résumés français des communications seront publiés dans l'*Archeion*, organe de l'Académie internationale d'histoire des sciences. Il sera décidé plus tard de la publication in extenso des communications.

Le comité d'organisation prépare une exposition de l'histoire des sciences, et des excursions, et il organisera des représentations de théâtre, concerts, réceptions etc.

Une réduction sur les chemins de fer sera obtenue, et sur demande des chambres d'hôtel seront retenues pour les congressistes.

La cotisation du Congrès a été fixée à 25 francs suisses pour les congressistes et à 15 francs suisses pour les membres de leurs familles. Y sont compris tous les frais sauf logement et nourriture, puis le banquet de clôture et l'excursion du 28 septembre.

Prière d'envoyer la carte d'adhésion aussitôt que possible.

Pour le Comité d'organisation :

Dr. Quido VETTER, professeur à l'Université Charles IV, Président de l'Académie internationale d'histoire des sciences réales et président du Comité d'organisation, Prague III, no. 557.

Dr. Fr. ULRICH, professeur à l'Université Charles IV, Sécrétaire Général du Comité d'organisation, Prague II. Albertov 6.

History of anesthesia.

Dr. CHAUNCEY D. LEAKE, Librarian and Professor of Pharmacology of the University of California Medical School, has given a special collection to the Crummer Medical History Room of items relating to the history of anesthesia. These range from 16th Century publications of VALERIUS CORDUS (1515-1544) who discovered ether, to autographed signed letters from Dr. CARL KOLLER who introduced local anesthesia in 1884. Included in the collection are inscribed volumes of HUMPHREY DAVY and HORACE WELLS who discovered the anesthetic properties of nitrous oxide, pamphlets and books dealing with MORTON, LONG and JACKSON's introduction of ether, material relating to SIMPSON's work on chloroform, CLAUDE BERNARD's, JOHN SNOW's, RICHARDSON's and GWATHMEY's general work on anesthesia, and correspondence, manuscripts and original documents concerned with recent developments in anesthesia including ethylene, " amytal," " avertin," " evipal," cyclopropane, divinyl oxyde, and Waters carbon dioxide absorption technique, pre-operative medication, and the prevention of local anesthetic toxicity. This collection is particularly interesting because of its relation to the scientific work on anesthesia which has been conducted for the past eight years in the Pharmacological Laboratory of the School.

Medical Stamp Exhibit.—A special exhibit of postage stamps relating to medicine has been arranged in the University of California

Medical School Library. It includes some 75 items, mostly from the collection of Dr. K. F. MEYER, Director of the Hooper Foundation for Medical Research, who is an ardent philatelist. Many countries have issued stamps commemorating medical events or physicians of prominence. Nearly all of these are on view in the exhibit. It is believed that this exhibit is the first of its kind to be assembled.

The San Francisco Medical History Seminar.—On November 18, 1936, the San Francisco Medical History Seminar gave a luncheon in honor of Dr. MAUDE E. ABBOTT, Curator of the Medical Museum at McGill University, Montreal. Dr. ABBOTT, who has made many important contributions to the history of medicine and nursing, adressed the Seminar on " The Young OSLER ".

The History of Science Dinner Club of Berkeley.—Dr. HERBERT EVANS, who organized the very stimulating History of Science Dinner Club in Berkeley, has arranged a program for this winter which carries along the general theme of last year's discussion. Special emphasis was placed last year on the relations of science and philosophy in the 18th and early 19th Centuries. This year the latter part of the 19th Century will be included. A consistently pleasing feature of the meetings has been an informal display of rare and interesting scientific literature.

Personalia. — *(Members of the H.S.S. are requested to send pertinent news for this section directly to M.* L. GUINET, II *Place Général Meiser, Brussels, Belgium.)*

Dr. GEORGE SARTON, Editor of *Isis* and *Osiris*, was elected an Honorary Fellow of the Royal Society of Edinburgh at the ordinary meeting of the Society held on July 6, 1936.

Prof. WILLY HARTNER was elected a corresponding member of the Forschungsinstitut für Kulturmorphologie at Frankfurt a.M. on July 17, 1936. He has been a curator of the same institute since 1934; he is now teaching the history of science at Harvard University.

CHARLES SINGER. — At the Convocation of Oxford University of July 23, 1936, the Public Orator presented various physicians for honorary degrees on the occasion of the Congress of the British Medical Association. Our members will be interested in his presentation of Dr. CHARLES SINGER, D.M., D. Litt., Magdalen College, Professor of the History of medicine in the University of London.

"Agmen claudit alumnus noster, prelo Clarendoniano bene notus, medicinae historiographus, neque medicinae solum sed universae scientiae naturalis. Hic a Graecis, ut par est, profectus, inde a Magica Arte ad Scientiam viam insectatus, Medicinae, Biologiae, totius Scientiae annales stilo iucundissimo breviter comprehendit. Ipse interea Conciliis maximis praesedit et in terris longe diversis prælectiones habuit. Quam non Americanorum Universitatem visitavit et doctrina sua illustravit? Hodie ut "ERASMO eruditissimo", qui iam diu apud nos et in medicina et in litteris Doctor eminet, tertium addamus doctoratum, praesento vobis CAROLUM SINGER, e Collegio Sanctae Mariae Magdalenae, in Universitate Londiniensi Historiae Medicae Professorem, ut admittatur honoris causa ad gradum Doctoris in scientia."

Reviews

Democritos. — *Fragments and Testimonials of Antiquity.* Edited, with commentaries, by G. K. BAMMEL. 382 p. Bound, Rbl. 6.70. Moscow, OGIZ, 1935. (In Russian).

A Russian translation of DEMOCRITOS appeared, in 1919, in the *Izvestiya* of the Azerbaijan State University; it was prepared by A. O. MAKOVELSKI, from DIELS' Fragmente der Vorsokratiker. BAMMEL's edition of DEMOCRITOS makes ample use of MAKOVELSKI's translation; the fragments dealing with physics are given, however, in the editor's own translation; long excerpts from LUCRETIUS are quoted in the hexameters of F. A. PETROVSKI.

In BAMMEL's edition, both the arrangement and the selection of the quotations differ from those found in DIELS. The main subdivisions of the translations are as follows : Life and works (19 p.); Natural philosophy (96 p.); History of civilization and origins of technology (25 p.); Logic and epistemology (43 p.); Ethics, politics, and pedagogics (32 p.); Pseudo-Democritic literature and imitations (14 p.). The editor admits, in his preface, that he — like DIELS — omitted a considerable amount of medical and technical fragments, and justifies this omission by the "narrowly specialized character" of these fragments; the book is intended for the "wide circles of readers who are studying the history of philosophy of science and of technology." The editor points out, furthermore, that he neglected part of the pseudo-Democritic literature, but included some material not found in DIELS. The sources of the quotations are indicated in the footnotes to the translations; an alphabetical index of sources fills ten double-column pages at the end of the volume. There are no cross-references to the DIELS numbers of the quotations, so that a reader who wants to compare the Russian translation of a fragment with the Greek text, is obliged to use the Stellenregister in DIELS. There is no index of proper names. An analytical table of contents fills two pages, and replaces, in a way, a missing subject index. The editor's critical and exegetic commentaries, Democritea (96 p., plus 13 p. of notes), form a very readable essay — and an integral part of this valuable volume.

According to the "colophon" license notice, 10.000 (ten thousand)

copies of this book have been printed; the supply will, probably, exceed the demand of Russian readers interested in classical philology, Greek philosophy, the history of science and technology, and similar branches of learning; one of the reasons for attempting to make DEMOCRITOS a best seller may be the fact, mentioned in the preface, that KARL MARX once wrote on the difference between the natural philosophy of DEMOCRITOS and of EPICUROS (1841). The jacket, binding, endpapers, Greek title-page used as frontispiece, the headpieces and tailpieces were designed by V. A. SELENGINSKI; it is to be regretted that the headpiece on p. 15 offers to the innocent readers a sketch of the Parthenon as an enneastylos temple.

A. P.

S. D. F. Goitein.—*The Ansāb al-ashrāf of* AL-BALĀDHURĪ, published for the first time by the School of Oriental Studies, Hebrew University, Jerusalem. Vol. 5 in two parts. 32 p. in English + 440 p. in Arabic + 27 p. in Hebrew; vi + 88 p. in English. Jerusalem, University Press, 1936.

Though less known than BALĀDHURĪ's other work, *Futūḥ al-buldān*, describing the early Islamic conquests, the *Ansāb al-ashrāf* was not unknown. W. AHLWARDT published a small part of it (one twenty fifth of the whole) in 1883. Twenty years later C. H. BECKER discovered the only complete ms. of it in Istanbul and announced his intention of publishing it. Various scholars offered their collaboration, but little was actually done until the project was intrusted to the School of Oriental Studies of the Hebrew University in Jerusalem. The great undertaking was then very carefully planned in that new School by its own staff with the advice of the late Prof. HOROVITZ and Prof. WEIL. It was decided to begin with the nucleus of the work, the story of the Umayyad caliphate which fills one third of it, and is of special interest. The present volume, first to appear, contains the history of 'UTHMĀN and MARWĀN and their families, and of the caliphate of IBN AZ-ZUBAIR in the times of MARWĀN and 'ABD AL-MALIK. Another part (vol. iv 6) entrusted to Dr. MAX SCHLOESSINGER is already in the press.

The *Ansāb al-ashrāf wa akhbāruhum* (the genealogies and histories of the nobles) composed by AL-BALĀDHURĪ (1), is an enormous work covering 1227 p. in the Istanbul MS., and of which the present massive volume represents but a tenth. It is larger than the *Ṭabaqāt* of IBN SA'D (d. 845) and but slightly smaller than the *Ta'rīkh* of ṬABARĪ (d. 923) (2).

(1) Died 892. See my *Introduction* 1, 616.
(2) See *Introduction* 1, 579, 642.

The boldness of the Hebrew University in beginning its Arabic publications with such a large one is thus clear enough; however this is not a reckless undertaking, but one deliberately planned in its totality as well as its smallest details.

This book represents an important class of Arabic historiography, which might be called the ansāb (or genealogy) literature, as opposed for instance to the ṭabaqāt literature. The ansāb books are dominated by the idea of Arabic aristocracy. (By the way, in the title of al-Balādhurī's book the word "ashrāf" does not mean descendants of the Prophet, but "nobles," that is Arabs belonging to old Arabic families, of pure descent on the father's side). The ṭabaqāt books on the contrary are of Islamic inspiration. However, if genealogy is the frame of BALĀDHURĪ's book, its substance is considerably richer.

The most remarkable feature of AL-BALĀDHURĪ's work it its objectivity. Think that we have here a book written in 'Abbāsid days, yet speaking at considerable length of the achievements of the rival dynasty, without partisan bias. This confirms Prof. D. S. MARGOLIOUTH's estimate of Arabic historiography (Calcutta 1930; *Isis* 23, 574), and makes us realize once more the superiority of Islamic culture over the contemporary Christian culture.

This is not the place for a technical criticism of GOITEIN's edition, but we may remark that it is apparently excellent. The printing is beautiful, the indices abundant and compiled with considerable care, and the publication of the notes in a separate book extremely convenient. This book is fittingly sacred to the memory of LEVI BILLIG, who "died a martyr's death in Jerusalem, 20 August 1936."

Will the intellectual leaders of the Arabs appreciate the splendid peace offering which the Hebrew University is extending to them? I hope they will and that the moderate members of the Jewish and Arabic parties will not allow any longer extremists of either kind to jeopardize Palestinian destinies. GEORGE SARTON.

Hartley, Sir Percival Horton-Smith; Aldridge, Harold Richard. — JOHANNES DE MIRFELD *of St. Bartholomew's Smithfield. His life and works.* XVI + 191 p. Cambridge University Press 1936 (15s).

A very welcome study of a fourteenth century author of medical and theological works. Not much is known about his life but he was probably a priest who spent most of his life in a priory of Augustinian canons and was connected in some capacity with St. Bartholomew's Hospital. His writings are the first of a medical nature known to be associated with any English hospital.

Although the life and writings of JOHN OF MIRFELD (died 1407) have been discussed by several previous writers, A. J. HORWOOD in 1869, H. T. RILEY in 1877, and Sir NORMAN MOORE in several studies, none of these earlier account is complete or entirely accurate. JOHN did *not* study in Oxford under NICHOLAS TYNGEWICH, Physician to EDWARD I, he was *not* a trained physician or surgeon, and he was *not* an Augustinian canon.

JOHN OF MIRFELD was the author of two lengthy compilations, the *Breviarium Bartholomei* written between 1380 and 1395, and the *Floriarium Bartholomei* completed about 1404. His purpose in composing the *Breviarium* is best expressed in his own words, "I have found and gathered together certain noteworthy matters of a medical nature culled from various sources, such as texts and glosses of the Art of Medicine, as well as the works of many writers who have treated of this science skilfully and fully..." "It has frequently happened that I have experienced the fraudulent practices of modern physicians, either when I myself needed their services, or when my friends were ill. Some of these practitioners were led by avarice to promise that they would cure a disease concerning which they were ignorant. Some impudently exacted a high price for medicines of little efficacy or intrinsic value : whilst others of the breed protracted the treatment over a considerable period, in cases where the infirmity could have been healed within a few days, just in order that they might have their patients as tributaries for a long time. Wherefore it seemed to me that it was both necessary as well as useful that I should write down within one breviary the various remedies applicable to each disease..." (HARTLEY & ALDRIDGE, 47, 49-51).

The value of JOHN's compilation lies in its relative completeness so that the reader may gain a good idea of the state of medical knowledge in a London hospital in the latter part of the fourteenth century.

The *Floriarium Bartholomei* is a collection of quotations from theological works made to further the spiritual well-being of his readers. It includes one very interesting chapter on "Physicians and their medicines" which deals first with medical deontology and then with diet regimes for various diseases.

The authors of this biography have included several long extracts (with translations) from the *Breviarium*, e.g. Proemium, De signis malis, De ptisi, Pulvis pro instrumento bellico, Emplastrum Bartholomei, De ponderibus et mensuris, Epilogue; and three from the *Floriarium*, the Proemium, De medicis et eorum medicinis, and Epilogue.

Three appendices conclude the work; the first two containing notes on the MSS of JOHN's two books, and a third entitled "Abstracts from deeds and documents referred to in the text."

This biography is written in a scholarly manner and is a valuable study of English medical knowledge in the fourteenth century.

Cambridge, Massachusetts. MARY CATHERINE WELBORN

Richard Salomon.—*Opicinus de Canistris. Weltbild und Bekenntnisse eines avignonesischen Klerikers des 14. Jahrhunderts.* Mit Beiträgen von A. HEIMANN und R. KRAUTHEIMER. Textband, viii+348 p. Album (35 × 25 cm.), xlv pl. London, Warburg Institute, 1936.

This interesting and splendid publication is issued by the Warburg Institute, dedicated to the study of classical traditions. That Institute, directed by Dr. FRITZ SAXL and formerly in Hamburg, is now established in Thames House, Millbank (London S.W. 1). It was my privilege to visit it on two occasions, and to appreciate the great richness and commodity of its library and of its immense iconographic collections.

OPICINUS DE CANISTRIS is one of the most singular personalities of the fourteenth century, even of the Midle Ages. Born in 1296 in Pavia, he received a good education and became a parish priest, but his family being driven out by the Ghibellines in 1315, he spent the rest of his life in exile. After a few years of wanderings and sufferings of a kind which the vicissitudes of our own days have made but too familiar to us, he finally settled in the papal city of Avignon in 1329. He obtained a humble post in the poenitentiaria, which he continued to occupy until 1348; he died about the middle of the century.

The poor cleric wrote in 1329 a political treatise to ingratiate himself with JOHN XXII, then in the following year a charming little book in praise of his native city.

These are his main writings. We can easily imagine him fretting and brooding in the haughty city of Avignon, so distant in space and even more so in manners from his beloved Pavia. In Pavia he was in charge of a parish; in Avignon, ill, poor and lonely, he was simply one of the scriptores in one of the innumerable offices of the curia. It is true his widowed mother continued to console him, but he lost her in 1335, being then himself in the fortieth year of his life. He noted in his autobiography for that year.

(April 25) *Transiit ex hoc seculo mater mea*

(May 20) *Vera ablactatio mea audito obitu matris mee.*

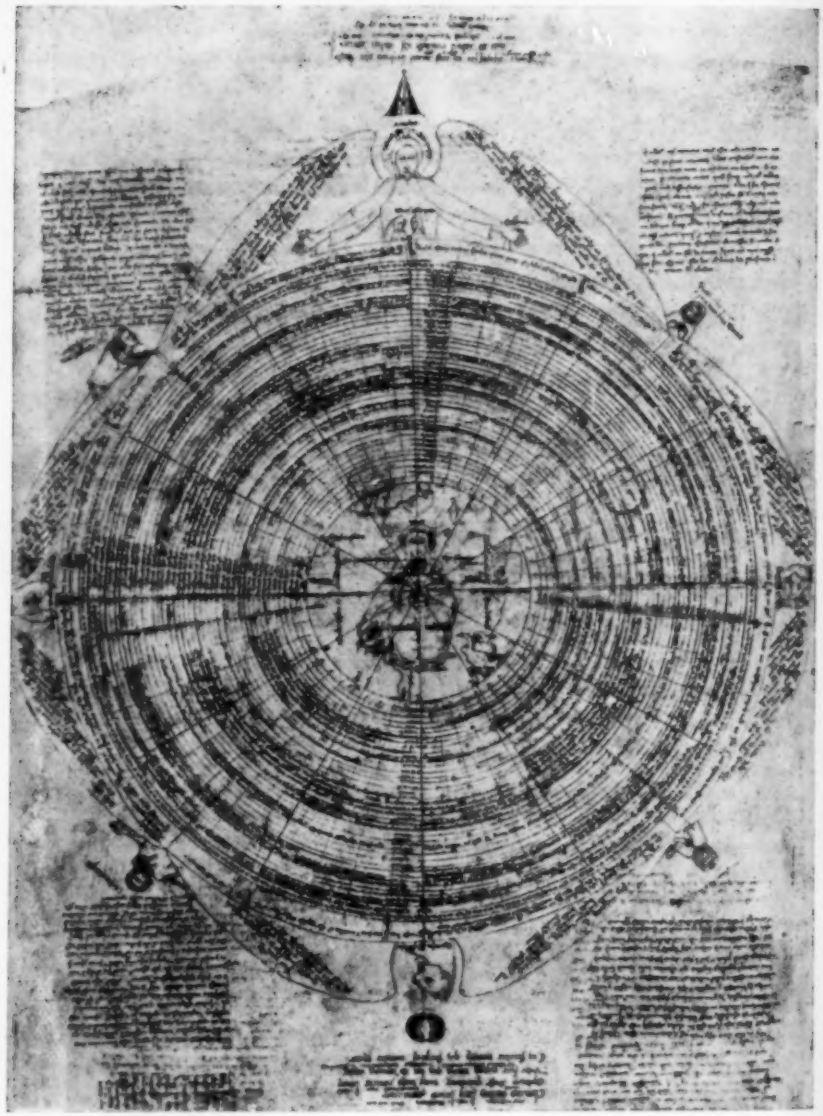
That final weaning was more than he could bear and his selfcenteredness and melancholy increased to a dangerous degree. It was about those years 1335-36 that he devoted much of his time drawing beautifully all kinds of maps, graphs, and schemas wherein he tried to organize his thoughts in his own peculiar way. There are altogether 52 such maps and schemas preserved in the *Codex palatinus latinus* 1993 (Vatican),

many of which are reproduced in SALOMON's atlas. OPICINUS' writings hardly deserve to be remembered (except perhaps in Pavia) but his charts will secure his fame, for they constitute a unique collection in mediaeval literature.

They are of various kinds : maps and other graphs, but all have in common a great love of symbolism and occultism, which had become the last refuge and consolation of his soul. There is often (e.g., in the maps) a combination of very concrete and precise facts with allegorical and mystical interpretations. OPICINUS had also a deep sense of his own sinfulness, and his confessions are equally terse and candid, again with hardly anything else comparable in mediaeval literature, except perhaps a few interpolations in the chronicle of THIETMAR OF MERSEBURG (XI-1, see *Introduction* 1, 733). Says Dr. SALOMON :

„Es ist wohl mit Recht betont worden, dass 'der pessimistische Subjektivismus, wie er sich bei OPICINUS zeigt, wichtig für die Erkenntnis der ganzen Zeitpsyche ist.' Da bei dieser Gelegenheit auf DANTE hingewiesen worden ist, erscheint es aber doch notwendig vor einem Irrtum zu warnen : vor dem Gedanken, dass es sich hier um eine besondere Form spätmittelalterlicher Religiosität handele. Was sich hier zeigt, ist vielleicht in der Stärke des Ausdrucks, aber nicht im Wesen etwas Neues. Verwandte Formen von religiöser Angst, von Schuld- und Sündengefühl kommen schon viel früher vor. Natürlich ist nicht jede Äusserung asketisierender Selbstanklage hier mit einzuordnen; aber es ist überraschend zu sehen, wie 300 Jahre vor OPICINUS ein Mann von ganz anderer Herkunft, Lebensart, sozialer und kirchlicher Stellung seine inneren Nöte in ähnlichen Formen ausspricht wie unser Autor. Es ist der Bischof THIETMAR VON MERSEBURG, der bekannte Chronist aus der Ottonenzeit. Seine Geschichtsdarstellung ist durchsetzt mit Selbstbetrachtungen und Selbstanklagen, die in ihrer Eindringlichkeit und Ausführlichkeit doch zu stark wirken, als dass sie bloss für geistliche Phrase gelten dürften. Genau wie bei OPICINUS tritt bei THIETMAR das Gefühl versäumter Pflichterfüllung im geistlichen Amt zutage, ebenso wie das Missfallen an der eigenen körperlichen Erscheinung. Zwar erreicht THIETMAR weder das Mass subjektiver Verstiegenheit noch die Abgründe völliger Verzweiflung wie OPICINUS; aber die Ähnlichkeit des gesamten Verhältnisses zu Welt und Leben ist unverkennbar." (p. 50).

The maps and drawings of OPICINUS had been studied ten years ago by FAUSTINO GIANANI (*Opicino de Canistris, l'anonimo ticinense*, Pavia 1927, 163 p., 6 pl.), but rather from the point of view of Pavian and Lombardian archaeology ; the scope of SALOMON's investigations is broader. We owe him an elaborate analysis of these strange documents, e.g., of the maps in their relationships with contemporary portolani (pp. 52-81), of the curious calendars, of the astrological elements. Then in the second part he gives us a minute description of each plate, one by one, which is the more valuable as the reproductions included in the atlas, large as they are, are too small for legibility.



The most extraordinary of these documents is an autobiography which he completed on June 3, 1336. Around a central circle containing the images of the Virgin and Child are drawn forty concentric circles, each of which corresponds to one of the forty years of his life 1296-1336. Each circle is divided into 366 parts. Hence any dated event

of his life is univocally connected with a point of that diagram. Brief autobiographical data are inscribed each in its proper place. See our facsimile, which is far too small to be legible, but explains the scheme; for the text see SALOMON's book, pp. 204-20. I copy a few extracts:

1296	March 24.	Conceptio in iniquitatibus ex legitimo matrimonio.
	Dec. 24.	Nativitas in peccatis in loco Lomelli.
1297	Jan. 1.	Circumcisio a peccatis in adoptionem filii Dei.
	July 1.	Circumcisio a superfluis ad contenta nature.
1302	Jan.	Hoc anno fuit ostensus mihi Christus Dominus crucifixus per animam meam, ut ipsum crederem verum dominum, nec unquam deinceps credidi aliter.
1304	End of April.	Pueriliter cum sorore me minore exprobrando ludebam. In illo loco cum illa fui crismatus per episcopum Vercellensem.
1305	(Jan.)	Reversus ad patriam fuit mihi apertus mirabiliter intellectus, quod multis incredibile esset, nisi testes adessent, me tamen invite discente.
	(End of April)	Puerilibus vitiis resistere nesciebam; magis festiva ocia quam litterarum studia diligebam.
1336	May.	Perdita scientia litterali in duplo restituitur mihi scientia spiritualis; dextera mea ad temporalia debilis, ad spiritualia fortis.
	June 3.	Hac die consumatum est opus huius vasis.

These few indications will suffice to indicate the psychological interest of that circular autobiography. This is not the place for a longer analysis of it. Because of Dr. SALOMON's excellent study I will devote a note to OPICINUS in volume 3 of my *Introduction* and try to replace him in his fourteenth century background. GEORGE SARTON.

Daniel Van Damme. — *Ephéméride illustrée de la vie d'Erasme.* Édition du IV^e^ centenaire de la mort d'Erasme, 1536-1936. Anderlecht-Bruxelles, la Société Anonyme de Photogravure d'Art, 1936. (35 francs belges; édition de luxe, 50 frs.).

The editor of this magnificent book is the Conservateur de la "Maison d'Erasme" (Musée d'Anderlecht). ERASMUS died in 1536, during the night of July 11/12 (Julian calendar); the colophon bears the date, July 12, 1936. The character of this quatercentennial contribution is indicated by the first two words of the title: it is a chronological synopsis of the life of Erasmus rather than a biography, and the illustrations form an integral part of it.

The text is printed in double columns. The chronological framework is formed by the bold-face dates, each date being followed by one or several concise statements, or brief comments on the corresponding events — often in ERASMUS' own words, or in an appropriate quotation

from other sources; references to the illustrations are given throughout the text. Years are grouped into periods, under such titles as "Troisième séjour en Angleterre," "Premier séjour à Bâle," etc.

"Les biographies d'ERASME, par leur nombre et leurs tendances, présentent parfois des variantes, notamment en ce qui concerne la chronologie. Pour parer à cet inconvénient, j'ai coordonné ces différents textes de façon à établir une "Ephéméride de la Vie d'Erasme", qui permette au lecteur de trouver aisément et en bonne place les principales étapes de cette existence de "Prince des Lettres," si mouvementée et si féconde. Parmi la succession des dates, je n'ai retenu que celles qu'il est possible d'étayer de documents considérés comme irréfutables et qui sont consignés dans l'œuvre monumentale consacrée par P.S. et H.M. ALLEN à ERASME et à sa Correspondance. Dans les cas douteux, je me réfère aussi à l'excellent ouvrage sur Erasme du Professeur J. HUIZINGA, de Leiden, dont les données concordent avec celles de P.S. et H. M. ALLEN." (p. 3).

The selection and arrangement of the illustrations complete the ephemeris : they appear, as a rule, on the same page as the text, or on the page preceding or following the text. The illustrations reproduce portraits of ERASMUS and his contemporaries, old maps and contemporary views of cities, drawings and photographs of houses, title-pages and marginal sketches, documents, medals, etc. The large size of the book — 24.5 by 31.5 cm. — makes it possible to reproduce several items on one page, without loss of detail. There are about two dozen reproductions of portraits and sketches of ERASMUS — six of them are full-page size; four portraits, two woodcuts, and one sketch of ERASMUS are by HANS HOLBEIN, the younger; DÜRER is represented by a portrait and a sketch of ERASMUS. Of the 127 numbered illustrations, about one fifth are major and minor HOLBEIN items; to this ought to be added the groups of his woodcuts used to decorate the title page and the preface, and the Dance-of-Death-alphabet initials throughout the volume. VAN DAMME has succeeded, by his judicious use of illustrations, in bringing ERASMUS and his time as close to modern readers as it was possible to do through the medium of three-score printed pages. The publishers-printers have produced a beautiful book.

A. POGO

Descartes. — *Correspondance, publiée avec une introduction et des notes*, par Ch. ADAM et G. MILHAUD. Tome I, X + 477 pp., Paris, ALCAN, 1936 (80 francs).

Cette édition met la correspondance de DESCARTES (lettres de et à DESCARTES) à la portée d'un très vaste public. Elle a pour auteurs MM. CHARLES ADAM, membre de l'Institut, un des éditeurs de la grande édition Adam-Tannery des *Œuvres de Descartes* (12 vol. + un supplé-

ment; Paris, 1897-1913), et GÉRARD MILHAUD, fils de GASTON MILHAUD. M. ADAM avait déjà publié, voici peu de temps, un nouveau classement de la Correspondance *(Revue philosophique*, 115, 373-401, 1933*)*, en tenant compte notamment des lettres découvertes depuis l'édition Adam-Tannery et dont, comme on sait, l'ensemble le plus nombreux (une centaine de lettres environ) a fait l'objet d'un volume : *Correspondence of Descartes and Constantyn Huygens*, 1635-1647, by LEON ROTH (Oxford, Clarendon Press, 1926); c'est dire que la présente édition est plus complète en ce qui concerne le nombre de textes originaux, puisqu'on a pris en considération les trouvailles et les études contemporaines, et qu'aussi l'ordre chronologique se trouve, dans la mesure du possible, rétabli.

Une traduction est jointe au texte des lettres qui n'ont pas été écrites directement en français, en sorte que toute la correspondance peut se lire uniquement en français; l'orthographe des lettres écrites directement en français a été modernisée. L'histoire de chaque lettre a été omise, les variantes négligées et les notes critiques réduites au strict minimum (nombre d'entre elles sont toutefois nouvelles). Ce premier tome nous donne la correspondance depuis 1619 jusqu'en 1637; il se termine par une table des auteurs cités, chacun de ceux-ci se voyant attribuer une note bio-bibliographique; malheureusement, les renvois aux pages, qui justifiaient cet index, sont fâcheusement incomplets.

On voit, d'après ce qui précède, que si les érudits ne consulteront pas sans profit l'édition que nous venons de décrire sommairement, ils continueront de toute évidence à préférer cependant la grande édition Adam-Tannery, que compléteront les lettres nouvelles publiées et commentées depuis ainsi que les travaux relatifs à la correspondance. Mais on ne saurait témoigner assez de reconnaissance à MM. ADAM et MILHAUD, sans oublier la maison ALCAN, d'avoir contribué par leurs efforts à vulgariser sous une forme pratique des textes fondamentaux et captivants.

Il n'existe pas d'iconographie cartésienne. Pourquoi ces savants éditeurs ne nous en donneraient-ils pas une, en appendice à leur belle publication ?

J. PELSENEER

François Charles-Roux. — *Bonaparte, gouverneur d'Égypte*. 383 p., 25 fig., 1 carte. Paris, PLON, 1935. (30 fr.).

A première vue on pourrait croire que ce livre ne concerne guère les lecteurs d'*Isis*, mais ce serait là une grosse erreur. L'histoire de l'Institut d'Égypte (qui fut un des résultats — le seul vraiment glorieux — de l'expédition d'Égypte) les touche de très près. Elle constitue un

des épisodes les plus passionants de l'histoire de la science à la fin du XVIII[e] siècle. J'en ai déjà parlé dans mon compte rendu du beau livre de M. LOUIS DE LAUNAY sur MONGE (1933, *Isis* 22, 242-5). Voir aussi la note relative au livre de M. ALFRED LACROIX sur DOLOMIEU (1922, *Isis* 5, 158-9).

Je n'aime guère à profaner le mot "héroïsme" à propos de l'expédition d'Égypte qui fut téméraire jusqu'à la folie, brutale et cruelle, mais on peut bien l'employer quand on parle de cet Institut dont les membres furent vraiment des héros et des martyrs de la science. L'histoire de la conquête française de l'Égypte a deux faces, d'une part, le côté noir qui nous révèle dans toute sa hideur l'égoïsme, la cruauté, la duplicité de BONAPARTE, et le côté blanc qui nous révèle son génie d'organisation et son amour tout à fait sincère de la recherche scientifique. D'une part il suffit de nous rappeler ses exécutions froides et systématiques qui ne cessèrent jamais, une série de crimes odieux qui culminèrent dans la massacre en masse des prisonniers turcs à Jaffa, sa politique islamique pleine d'équivoques et de mensonges, son attitude vis-à-vis des pestiférés (v.p. 333), en un mot, son manque complet de scrupules moraux. D'autre part le recrutement de l'Institut d'Égypte est tout à fait merveilleux. Grâce à BONAPARTE il a existé pendant deux ans dans ce pays lointain et exotique une compagnie de savants d'un éclat extraordinaire. En voici le tableau au moment de la fondation le 20 août 1798 (p. 157).

"*Section de mathématiques* : BONAPARTE, FOURIER, COSTAZ, NOUET, QUESNOT, LE PÈRE, GIRARD, LE ROY, ANDRÉOSSY, SAY, MALUS, MONGE. *Section de physique* : BERTHOLLET, DOLOMIEU, CONTÉ, GEOFFROY SAINT-HILAIRE, DESCOTILS, SAVIGNY, DUBOIS, DESGENETTES, CHAMPY, DELILLE. *Section d'économie politique* : CAFFARELLI DU FALGA, GLOUTIER, SUCY, SULKOWSKI, TALLIEN, POUSSIELGUE. *Section de littérature et des arts* : PARSEVAL-GRANDMAISON, VENTURE DE PARADIS, NORRY, DUTETRE, VIVANT-DENON, RIGEL, REDOUTÉ, un prêtre grec (qui fut don RAPHAËL DE MONACHIS)."

La première section — la seule qui ait atteint le chiffre maximum de douze membres — est la plus brillante; c'était aussi celle dont le "citoyen BONAPARTE" faisait partie en qualité de simple membre. Elle contenait quatre géants : FOURIER, MALUS, MONGE et BONAPARTE; la seconde en contenait cinq : BERTHOLLET, DOLOMIEU, CONTÉ, GEOFFROY SAINT-HILAIRE, DESGENETTES. Les autres sections étaient comparativement médiocres, on voit que le Maître ne s'en était pas occupé. Cependant nous y voyons VIVANT-DENON, qui fut un des fondateurs de l'égyptologie. Dès le début, l'Institut d'Égypte manisfesta une vraie fièvre de travail et son atmosphère fut toujours fort différente de celle des respectables et somnifères académies de notre temps. C'est qu'en

effet c'était une académie de jeunes, non pas de vieillards, et c'est en cela que le génie de BONAPARTE se révèle : il avait collectionné tous ces gens illustres *avant* qu'ils ne fussent illustres, — à l'exception de MONGE et de BERTHOLLET qui l'étaient déjà. MONGE était d'ailleurs le doyen

LA DÉCADE

EGYPTIENNE,

JOURNAL LITTÉRAIRE

ET

D'ÉCONOMIE POLITIQUE

PREMIER VOLUME.

AU KAIRE,

DE L'IMPRIMERIE NATIONALE.

AN VII DE LA RÉPUBLIQUE FRANÇAISE.

de l'Institut; il avait 52 ans au moment de sa création. VIVANT-DENON en avait 51, BERTHOLLET, 50, DOLOMIEU 48, CONTÉ 43, DESGENETTES, 36, FOURIER 30. Les plus jeunes étaient BONAPARTE 29, GEOFFROY 26 et MALUS 23.

Un autre sous-produit de l'expédition fut la fondation d'une imprimerie (ou de deux imprimeries) d'où sortirent les "incunables" de l'Égypte.

"Un maître imprimeur français, qui a étudié les débuts de son art en Égypte, énumère vingt et un ouvrages, opuscules ou documents, sortis des presses, soit de MARC AUREL, soit de MARCEL, entre 1798 et 1801. On y remarque, en plus de ceux que nous avons déjà cités et des deux journaux mentionnés, la traduction

COURIER DE L'EGYPTE.

N.° I.cr

LE 12 FRUCTIDOR, VI.e ANNÉE DE LA RÉPUBLIQUE.

NOUVELLES.

Corfou, 27 *messidor an* 6. Le vaisseau de guerre *le Stengel* est arrivé d'Ancône dans ce port, escortant un convoi de trois mille Français qui sont venus pour renforcer la garnison des îles Ioniennes.

La prise de Malte par la France a fait ici une joie universelle. Les départemens d'Ithaque, de Corcyre et de la mer Egée sont dans la situation la plus satisfaisante; il y règne le plus grand enthousiasme pour la liberté, et le plus grand attachement à la mère patrie.

De Janina, *le* 15 *messidor*. Notre Pâchâ est toujours sous les murs de Widdin, commandant en second l'armée du grand seigneur sous le capitan-pâchâ, qui est destinée à faire la guerre à Passewan Oglou qui reprend toujours de nouvelles forces. Après le combat malheureux où notre armée a perdu 700 hommes, et a été obligée d'abandonner le champ de bataille, l'armée de ce rebelle s'est encore augmentée.

Il y a quelques jours, est arrivé ici l'adjudant général Rose qui a eu une audience de cérémonie du fils du pâchâ, à l'issue de laquelle il a été expédié un courier sur un dromadaire, portant au pâchâ une dépêche extraordinaire.

Malte, 25 *messid*. La fête du 14 juillet s'est célébrée ici avec la plus grande pompe. Les bienfaits de la liberté se font sentir dans toutes les classes; il n'est pas un seul Maltais qui ne bénisse l'heureux changement qui a eu lieu.

Trois frégates anglaises bloquaient notre port. Le vaisseau de guerre *le Dego* et la frégate *la Carthaginoise* sont sortis pour leur donner chasse.

Le vice-roi de Sicile avait refusé de nous donner des vivres; mais sur les instances de notre ambassadeur à Naples, il vient de permettre l'exportation de la Sicile. Au reste nous avons du bled pour la garnison et les habitans pour dix-huit mois.

Tripoli, 28 *messidor*. Le pâchâ de Tripoli, dès l'instant qu'il a eu reçu la demande du Général en Chef, de mettre en liberté tous les esclaves maltais (le Général en Chef lui avait envoyé une grande quantité de Tripolitains et autres esclaves turks) les a envoyés par un bâtiment à Malte, avec une grande quantité de bleds et de fruits, et quatre superbes chevaux de race dont il a fait présent au général commandant à Malte.

Alexandrie. La ville est encombrée de matelots et d'équipages de nos vaisseaux, provenant de l'escadre. Tous les prisonniers ont été rendus.

par MARCEL des *Fables de Loqman, surnommé le Sage*, une *Grammaire arabe vulgaire à l'usage des Français et des Arabes*, une *Description de l'ophtalmie d'Égypte*, par ANTOINE SAVARESI, en italien et en arabe, un *Avis sur la petite vérole régnante*, adressé en arabe et en français au Divan du Caire par DESGENETTES, un *Annuaire de la République française calculé sur le méridien du Caire, l'an VIII de l'ère française*, une *Notice des événements qui ont eu lieu en Europe pendant les quatre premiers mois de l'an VII de la République*, la Constitution de l'an VIII, la procédure du procès et le jugement de l'assassin de KLÉBER, un journal arabe créé par MENOU sous le titre *El-Tanbyeh*, c'est-à-dire *l'Avertissement*." (p. 152).

Le maître imprimeur auquel l'auteur fait allusion et sans doute ALBERT GEISS : *Histoire de l'imprimerie en Egypte* (1 plaquette, Le Caire 1907),

ouvrage qui ne m'est pas encore tombé entre les mains. Quant aux deux journaux, ce sont le *Courier de l'Égypte* dont le premier numéro est daté du 12 fructidor VI (29 août 1798) et parut tous les cinq jours, chaque quintidi et chaque décadi, et *La décade égyptienne* qui naquit le 10 vendémiaire VII (1 octobre 1798) et parut chaque décade. Le *Courier* était un journal d'informations locales et politiques, censuré et proprement cuisiné par les bureaux de l'État-major; il parut en tout 116 nos. de 4 p. in 4°. La *Décade* au contraire était un journal littéraire et scientifique qui publia des études importantes sur l'histoire naturelle et l'archéologie égyptiennes. C'était en quelque sorte, le moniteur et bulletin de l'Institut d'Égypte; ses volumes "présentent un raccourci des travaux de cet Institut dans toute leur variété, mais parfois dans leur technicité un peu ardue; et ce raccourci en devait rester le seul témoignage imprimé, jusqu'à la publication à Paris, par DIDOT, entre l'an VIII et l'an XI, des quatre volumes intitulés : *Mémoires sur l'Égypte.*" (p. 152). Grâce à la courtoisie du British Museum je suis à même de reproduire ici les pages de titre de ces deux périodiques qui sont l'Adam et l'Ève de la presse égyptienne, polyglotte et gigantesque. (1)

Il est temps de terminer ce compte rendu mais je ne puis le faire sans avoir rappelé le principal titre de gloire de BONAPARTE gouverneur d'Égypte : la fondation de l'égyptologie (p. 346) :

"Le court paragraphe du compte rendu de l'Institut, annonçant la découverte de la pierre de Rosette, dresse en quelque sorte l'acte de naissance de l'égyptologie. L'égyptologie est fille de l'expédition française, MASPERO disait d'elle qu'elle avait ses papiers de famille dans la campagne de BONAPARTE. Elle est née du contact pris avec le patrimoine monumental et épigraphique de l'Égypte par les savants et artistes à la suite de l'armée. Son premier berceau fut ce palais de Quassim Bey, qui abritait l'Institut, la commission, leurs archives, leurs collections, et la promesse de son magnifique développement était contenue dans l'énigmatique stèle trouvée par BOUCHARD, signalée par LANCRET, interrogée par MARCEL. BOUCHARD avait passé par Polytechnique, comme LANCRET. L'écriture des Égyptiens de l'antiquité était une inconnue, qui devait tracasser ces deux anciens de l'X. Mais combien une inscription lapidaire, même unique en son genre, eût-elle risqué de passer inaperçue d'un officier du génie, dans un pays où tant de pierres portaient des signes inintelligibles, si le mot d'ordre de recueillir tout ce qui pouvait être exploité par la science n'avait été répandu du haut en bas de la hiérarchie militaire, et si l'ambition de concourir aux recherches scientifiques n'avait stimulé dans l'armée l'obéissance à cette consigne ! Combien aussi la providentielle trouvaille de BOUCHARD n'a-t-elle pas dû à la chance d'avoir été immédiatement connue de LANCRET et annoncée par lui à l'Institut ! Là se vérifie l'utilité, et des instructions données par BONAPARTE pour que ses officiers prissent note de ce qui leur semblerait intéresser la science, et des tournées incessantes prescrites aux savants de toutes spécialités."

(1) Pour la presse égyptienne arabe, voir *Isis*, 25, 270, 1936.

L'ouvrage est fort bien écrit et se lit avec beaucoup de plaisir. Il est suivi d'une bonne bibliographie, mais le manque d'index est déplorable et scandaleux. L'auteur est ambassadeur de France auprès du Vatican; cela n'est pas une sinécure et il faut lui être d'autant plus reconnaissant de nous avoir donné ce livre bien étudié, bien fait, et aussi utile qu'intéressent.

GEORGE SARTON

Francis Sydney Marvin.—*Comte. The founder of sociology.* 216 p., frontispiece. (Modern sociologists, under the general editorship of MORRIS GINSBERG and ALEXANDER FARQUHARSON). London, CHAPMAN and HALL, 1936 (6 s.).

Henri Gouhier.—*La vie d'Auguste Comte.* 3e éd., 300 p., port. (Vies des hommes illustres, 63). Paris, GALLIMARD, 1931 (15 frs.).

Henri Gouhier.—*La jeunesse d'Auguste Comte et la formation du positivisme.* 1. *Sous le signe de la liberté.* 315 p., Paris, VRIN, 1933.

It is worthwhile to consider these three books on COMTE together. GOUHIER's second book (1933) is a very important contribution, based on carefully conducted and elaborate investigations. It is restricted to the first phase of COMTE's life, its subject being to determine the contents of the latter's *Weltanschauung* before 1818, i.e., before the age of 20 and his contact with SAINT-SIMON. This helps us to realize more clearly than before the extent of his borrowings from eighteenth century and revolutionary ideology. COMTE is truly a child of the Revolution; indeed one can find germs of many of his ideas and even of his aberrations in events and writings of his youth or anterior to it. To be sure that does not explain the miracle of his genius, but it replaces it in its proper setting.

While I have nothing but praise for this later volume, I do not feel in the same way with regard to the earlier one. Being commissioned to write it for a popular series, "Vies des hommes illustres," the author assumes a sardonic attitude and enlivens his account with flippant remarks which do not please me at all. He defends himself against the reproach of writing "une biographie romancée" and observes (p. 10) "La biographie d'AUGUSTE COMTE, c'est la vie de COMTE romancée par COMTE et 'déromancée' par l'histoire." Rather neat but misleading. COMTE was truly heroic in his aims and achievements, he was heroic also in his mistakes; we must see him in the light of his heroism because that was the true light of his being. I do not mean that we should heroify him, but it would be much worse still to unheroify him, or, to put it in American slang, to debunk him. I have

no patience whatsoever with debunkers, and though GOUHIER is not one of them his dangerous wit brings him sometimes close to them. One reason for not being witty at the expense of a great man, is that it is far too easy. His complete absorption in his task and unrestricted devotion to his purpose leave him unprotected and defenceless. Any idiot can make fun of a great man, and thus increase his self-esteem, but what of it? The great man remains as great and heroic as he was, and the other in spite of his complacency remains the self-same idiot. This is said in general not for GOUHIER, who is a far better man than his occasional sarcasm would suggest. Let those who have never sinned in that way, throw the first stone; I can't. I shall simply say that his book would have been much better if he had treated COMTE with more generosity.

MARVIN's book is the shortest and for most readers will prove to be the best. One cannot say that it is the best in an absolute way, for it is in a different class altogether. Biography is reduced to a minimum, the author's aim being rather to explain COMTE's philosophy and to answer such questions as these: "What did he really accomplish? how far did he succeed? what is his influence on our own thoughts? is it worthwhile to continue his work?" These are the very questions which an intelligent reader would ask, and they are answered with great clearness and directness. It is an excellent book which will inspire many men and women and help them to contemplate the world as COMTE saw it and apply their new understanding of it to the present difficulties.

GOUHIER and MARVIN illustrate the renewed timeliness of Comtian philosophy. COMTE wrote at a time when the world had been terribly shaken by the French revolution and the Napoleonic dictatorship; we may well reread him now, we who have survived the immense catastrophe of the Great War, and are witnessing to-day various dictatorships less grandiose than the Napoleonic but comparable in cruelty and wickedness. Read the first paragraph of his "Plan des travaux scientifiques nécessaires pour réorganiser la société" written in 1822 (Aet. 24) during his Saint-Simonian captivity (1).

(1) It was first printed in Paris, April 1822, in a pamphlet entitled *Du contrat social par* HENRI SAINT-SIMON. It was reprinted in 1824 with a few minor corrections ("retouches") in the third cahier of SAINT-SIMON's *Catéchisme des industriels* (189 p.). See figs. 1 and 2. COMTE reprinted it once more thirty years later in the appendix to the last volume of his *Système de politique positive* (Paris 1854, Appendice général, p. 47-136). I have not seen the first edition, but only the second and third. The second edition from which my quotation is derived, is said to be almost identical with the first. The first and second editions are exceedingly rare.

" Un système social qui s'éteint, un nouveau système parvenu à son entière maturité et qui tend à se constituer, tel est le caractère fondamental assigné à l'époque actuelle par la marche générale de la civilisation. Conformément à cet état de choses, deux mouvements de nature différente agitent aujourd'hui la société ; l'un de désorganisation, l'autre de réorganisation. Par le premier,

SYSTÈME

DE

POLITIQUE POSITIVE.

PAR AUGUSTE COMTE.

ANCIEN ÉLÈVE DE L'ÉCOLE POLYTECHNIQUE.

ÉLÈVE DE HENRI SAINT-SIMON.

TOME PREMIER.

PREMIÈRE PARTIE

A PARIS,

CHEZ LES PRINCIPAUX LIBRAIRES.

1824.

FIG. 1

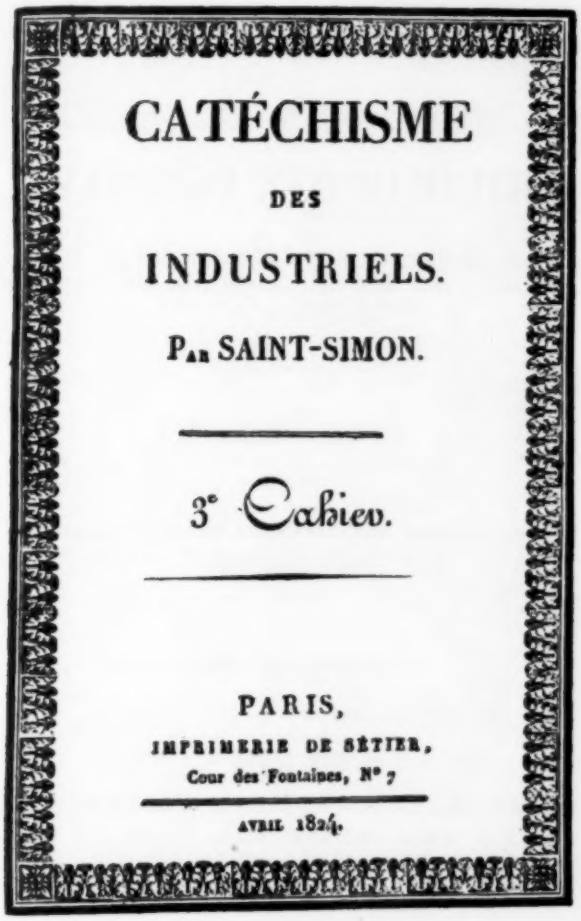
This outline of COMTE's work was first printed in 1822, then again in 1824, when the proud title *Système de Politique positive* first appeared.

The word *Système* is 53 mm. long.

(Courtesy of Harvard Library.)

considéré isolément, elle est entraînée vers une profonde anarchie morale et politique qui semble la menacer d'une prochaine et inévitable dissolution. Par le second, elle est conduite vers l'état social définitif de l'espèce humaine, le

plus convenable à sa nature, celui où tous ses moyens de prospérité doivent recevoir leur plus entier développement et leur application la plus directe. C'est dans la co-existence de ces deux tendances opposées que consiste la grande crise éprouvée par les nations les plus civilisées. C'est sous ce double aspect qu'elle doit être envisagée pour être comprise."


CATÉCHISME

DES

INDUSTRIELS.

PAR SAINT-SIMON.

3e Cahier.

PARIS,

IMPRIMERIE DE SÉTIER,

Cour des Fontaines, N° 7

AVRIL 1824.

FIG. 2

COMTE's *Système de Politique positive* was included in this Cahier. The word *Catéchisme* is 66 mm. long.

(Courtesy of Harvard Library.)

Could we not begin a political treatise with the same words or at least in the same vein to-day? According to COMTE the chief defect of the modern industrial system was the want of organization. If he

came back to-day, he would be obliged to admit that the progress already accomplished since his time, and somewhat along the lines indicated by him, has been prodigious and yet he would still repeat his statement and we repeat it for him. It is astonishing by the way that our Russian

COURS

DE

PHILOSOPHIE POSITIVE,

PAR M. AUGUSTE COMTE,

ANCIEN ÉLÈVE DE L'ÉCOLE POLYTECHNIQUE, RÉPÉTITEUR D'ANALYSE TRANSCENDANTE ET DE MÉCANIQUE RATIONNELLE A CETTE ÉCOLE.

TOME PREMIER,

CONTENANT

LES PRÉLIMINAIRES GÉNÉRAUX ET LA PHILOSOPHIE MATHÉMATIQUE.

PARIS,

BACHELIER, LIBRAIRE POUR LES MATHÉMATIQUES,

QUAI DES AUGUSTINS, N° 55.

1830

FIG. 3

Volume I of COMTE's *Cours*, completed in six volumes (1830-42). The words *Philosophie positive* are 89 mm. long.

(Courtesy of Harvard Library.)

friends who have shown so much interest in the history of science have not yet ventured to reread the Comtian documents in the light of their own extraordinary experiences.

MARVIN's sympathetic study and GOUHIER's second book made me realize more deeply than before the singular continuity and unity of COMTE's thought. I have already alluded to the fact that he did not

RÉPUBLIQUE OCCIDENTALE.

Ordre et Progrès. — Vivre pour autrui.

SYSTÈME DE POLITIQUE POSITIVE,

OU

TRAITÉ DE SOCIOLOGIE,

Instituant la Religion de l'HUMANITÉ;

PAR AUGUSTE COMTE,

Auteur du Système de philosophie positive.

L'amour pour principe,
L'ordre pour base,
Et le progrès pour but.

TOME PREMIER,

Contenant la DISCUSSION FONDAMENTALE, et la CONSTITUTION PRÉLIMINAIRE.

PRIX DE CE VOLUME : HUIT FRANCS.

PARIS.

A LA LIBRAIRIE SCIENTIFIQUE-INDUSTRIELLE DE L. MATHIAS,

15, quai Malaquais;

ET CHEZ CARILIAN-GŒURY ET Vve DALMONT,

LIBRAIRES DES CORPS DES PONTS ET CHAUSSÉES ET DES MINES,

49, quai des Augustins.

Juillet 1851.

Soixante-troisième année de la grande révolution.

FIG. 4

Volume 1 of the COMTE's *Système*, completed in four volumes (1851-54). The words *République occidentale* are 59 mm. long. Compare with fig. 1, same general title already used by COMTE in 1824.

(Courtesy of Harvard Library.)

hesitate to reprint at the end of his *Système de politique positive* in 1854 six prophetic essays of his youth (1819-28), one of which bore the very title of the general work which it preceded by thirty years. Furthermore,

GOUHIER has shown that some of the main Comtian ideas were even anterior to the Saint-Simonian period. Indeed some of the vagaries which are generally ascribed to the influence of his senile love for CLOTHILDE DE VAUX (2), were already adumbrated not only in pre-Clotildian writings, but even in pre-Saint-Simonian ones. The final stage of his life and thought was already foreshadowed in the dreams of his youth. Well might he inscribe at the beginning of his *Système de politique positive*, ALFRED DE VIGNY's saying , Qu'est-ce qu'une grande vie? Une pensée de jeunesse, exécutée par l'âge mûr," for these words applied to him with remarkable pertinence.

Such constancy, it is true, might be given another name : obstinacy, or an uglier one still, mulishness. These names have been applied to COMTE, and not unjustly. Like DESCARTES and BACON, and even more so, COMTE was a typical doctrinaire (3). The explanation applying to all of them, is that the effort needed to create their theories exhausted their minds and ended by making them impervious to other thoughts. In the case of COMTE the crisis of insanity which occurred at the beginning of his career (April 1826) remained throughout his life a menace which could not be shaken off or even forgotten. COMTE saved himself from relapse only by his obstinate will and devotion, and by a mental hygiene implying increasing aloofness and insulation from the madding crowd. He soon lost the habit of reading, and from 1838 on (Aet. 40 !) that kind of abstinence became systematic (4). In addition, COMTE acquired early a scholastic way of classifying his thoughts and arranging them in the form of symmetrical tables ; such a habit favors the crystallization of thought rather than its healthy growth (5).

No wonder then that that scientific philosopher was far from up-to-date and exhibited time after time a shocking lack of receptivity to contemporary discoveries. One might easily repeat with regard to him LIEBIG's savage onslaught on FRANCIS BACON (1863). COMTE's dogmatic negation

(2) It may interest historians of science to know that CLOTILDE DE VAUX (1815-1846) was the sister of MAXIMILIEN MARIE (1819-91), mathematician, author of the *Histoire des sciences physiques et mathématiques* (12 vols. Paris, 1883-88). It was at MAXIMILIEN's house that COMTE met her. CHARLES DE ROUVRE (b. 1871), author of *L'amoureuse histoire d'Auguste Comte et de Clotilde de Vaux* (Paris 1917), is MAXIMILIEN's grandson.

(3) Good illustrations of the doctrinairism of great men, not only philosophers but also scientists, and their mutual ignorance of one another will be found in the study prepared at my request by JEAN PELSENEER : GILBERT, BACON, GALILÉE, KÉPLER, HARVEY et DESCARTES : leur relations (*Isis* 17, 171-208, 1932).

(4) GOUHIER (1931, 185).

(5) For illustrations of that tendency, see three unpublished autographs of COMTE (*Isis* 13, 103-05, 1 pl., 1929).

of the possibility of astrochemistry has often been quoted, but there are worse examples of his blindness. He considered the calculus of probabilities as a " superannuated aberration " (6); he laughed at the " pretended " discovery of Neptune and scorned LE VERRIER; he could not accept LAMARCK's theories of evolution, and objected to anatomical autopsies! That damaging list might probably be lengthened, but what would it prove? It would prove that COMTE was not a scientist, but simply a philosopher, and an obstinate one at that. We may regret in his case, as in BACON's, that he was not better informed or more receptive to the ideas of other people, but our judgment of him will depend in the last analysis on our appreciation of his general ideas and their applications.

I am thankful to GOUHIER and even more so to MARVIN for having obliged me to return to COMTE and to revalue him. I hope that GOUHIER will continue the conscientious investigations of which his volume of 1933 offered us the first fruits, and that he may eventually complete a biography of COMTE in the grand style, together with a much needed index to the Comtian works and letters.

As to MARVIN our gratitude to him is of another and deeper kind. He is one of the leading and most faithful defenders of the noblest Comtian ideals: unification of science and of society, peace, Humanity. May I indulge for a moment in reminiscence? As I happened to be in London on December 31, 1919, MARVIN took me to dinner at the National Liberal Club, and later in the evening to Dr. CONGREVE's church in Chapel street, the Church of the Positivist Society, the final refuge of the London Positivists (7). The last day of the year was dedicated by them to a service of thanksgiving to the Great Dead. MARVIN was the main speaker and made a very moving address; I spoke after him but did not rise up to the solemn occasion and have been consciencestricken about it ever since. To conclude, MARVIN's revaluation of COMTE's thought is as good as it is timely. Read it!

GEORGE SARTON.

R. Campbell Thompson.—*A dictionary of Assyrian chemistry and geology.* xlviii + 266 p. Oxford, Clarendon Press, 1936 (21 s.).

I suppose many scholars will rub their eyes when they read this title, and wonder whether they read it aright. A dictionary of Assyrian chemistry and geology! If the author were less known than R. C. THOMPSON they might perhaps dispose of it, but a book bearing such

(6) Compare my remarks on the respective claims of QUETELET and COMTE with regard to the foundation of sociology (*Isis* 23, 14, 1935).

(7) F. S. MARVIN: FREDERIC HARRISON (1831-1923). *Isis* 6, 387-90, 1924.

a name cannot be lightly dismissed. His studies on Babylonian and Assyrian archaeology have been very frequently registered and often reviewed in *Isis*. To quote only a few examples, remember his *Assyrian medical texts* (Oxford 1923; *Isis* 7, 256), *The Assyrian herbal* (London 1924; *Isis* 8, 506-508), *The chemistry of the ancient Assyrians* (London 1925; *Isis* 9, 147).

The present highly technical work is so-to-say the crown of all his previous investigations. The author fully realizes the boldness of his undertaking. Says he in the Preface:

"It is with no little trepidation that I put forth this Dictionary. Properly to investigate the secrets of Assyrian chemical discoveries, apart from knowing the language and its cousins and the cuneiform texts, the seeker ought to have a knowledge of chemistry (including glass-making), medicine, geology, and botany, as well as to be conversant with the history and methods of the Alchemists of a later date... Not unnaturally in pursuing clues towards the solution of various Assyrian problems it has been more satisfactory to refer to books and authorities no longer modern, which were far more helpful for the purpose than those which include the advances made during the nineteenth century, particularly in technical science. These later discoveries, which cover vast territories unknown to the ancient world from electricity to aniline dyes, would merely have confused the issue, and this will explain the old quotations often made herein. Yet, although we have to feel our way cautiously in penetrating the arcana of ancient science (which, indeed, were often made purposely cryptic), and conservatively to restrain too eager an optimism about the old men of learning, it can definitely be said that research into the history of their discoveries shows astonishing and unexpected results. They had a sound, practical knowledge of simple chemicals, even to the making of the fuming sulphuric acid in producing colcothar from green vitriol. To go still farther (but in this case we have no definite proof) their apparent introduction of an infinitesimal portion of gold into glass to make '(red co)ral' goes far to suggest that they must have known how to dissolve gold in *aqua regia*. From the numerous results which they had obtained by trying the effect of fire and acids on vegetables and minerals, it is obvious that their inquiring minds, ready to explore any channel of discovery, had an initiative which led them far."

The dictionary proper is meant to be referred to rather than read continuously, but it is preceded by an introduction (38 p.) which is as readable as the subject allows. After referring to the latest discovery in ancient chemistry, a Babylonian tablet of the seventeenth century B. C. giving formulae for making a lead glaze coloured with copper (1), he remarks:

"It is written in just that same cryptographic method which was so beloved of those secretive alchemists of the Middle Ages, a very prototype of possibilities for which we must always be prepared. The fact that a familiarity with certain substances derived from research in natural secrets has not been shown earlier than in the writings of medieval chemists ought not to be allowed to prejudice

us against the claims of the more ancient craftsmen, whose credit is apparent in so many extant result of their skill.

There are three very cogent reasons for our ignorance of these actual processes, especially during that long period which bridges the gulf between the Fall of Nineveh in 612 B.C. and the beginnings of medieval alchemy. First, the actual records are too scanty for us to be able to link up the two periods; secondly, it has always been the outrageous custom of certain learned circles to conceal their knowledge from lay world in a fog of jargon, a pomposity of mannerisms due, it is to be hoped, less to personal vanity than to professional protection; thirdly, the knowledge of technical methods was closely guarded by each guild, a natural selfishness aided often by the illiteracy of the artificers who handed down their discoveries from father to son by word of mouth, and consequently their processes, dependent on oral tradition... ran the risk of oblivion. We find instructions for this secrecy as far back as the middle of the second millennium in a tablet of the Kassite period, which adds in a colophon to an explanatory text the warning *mudû mudâ likallim la mudû ul immar* ' let him that knoweth show him that knoweth, (but) he that knoweth not, let him not see ' (LANGDON, P.B.S. x, no. 4, 342), and a similar direction at the end of a seventh-century medical text, *mudû mudâ likallim mudû la mudâ la (ikal)lam* ' let him that knoweth show him that knoweth (but) he that knoweth shall not show to him that knoweth not ' (AM. 105, 24). Indeed, this jealousy is apparent often in the jejune descriptions made by classical authors, which suggest at least the suspicion that their informants were none too ready to reveal the delicate mystery of their craft to the first inquisitive collector of natural history. Such a palissade of concealment is not confined to antiquity, but has persisted to the present day, particularly among the glass-makers, who preserve not only the tradition of their ancestors' skill, but also their secretiveness. We can see in our Babylonian tablet of seventeenth-century chemistry every characteristic of the later specialists. The writer makes a point of using the strangest possible cuneiform signs, and at the same time rare or, for that matter, new values to some of those others which are better known to us; he uses Sumerian ideograms in such a way as to show that he intends to pun on the value of the Semitic equivalents, taking for instance the sign for ' eagle ' in Sumerian, which has the Semitic value *erû*, which is ingeniously meant here to be read as *erû* ' copper.' For whom he intended this text we cannot say, but the handwriting is so beautiful that it suggests the existence of a professional library.

His is the most difficult expression of this professional jealousy yet known in Mesopotamia. There is a similar but simpler method employed by Assyrian physicians and astrologers, who do not, it is true, attempt any such gross usage of cuneiform signs as this, but they do employ an abbreviated language, different from that of the historical texts, relying greatly on a use of Sumerian values, and certainly warranting the view that they, too, intended to conceal their professional knowledge from the layman. These medical texts are constant in their preference for the Sumerian names of drugs rather than their every-day Semitic forms, just as the medical specialist to-day will employ Latin equivalents, the chemist his alphabetic formulae, and the botanist his special terms, although, of course, the Sumerian language did not, as far as we know, hold the same

(1) C. J. GADD and R. C. THOMPSON : A middle-Babylonian chemical text (*Iraq* 3, 87-96, 1936). Long extract in *Isis* 26, 538.

claim to represent an intentional cosmopolitan denotation. We find, too, that same queer use of bizarre synonyms of which the medieval scholars were so fond : the Assyrian was as ready to call what was almost certainly opium by the name of ' lion fat ' *(lipî nêši)* or ' human fat ' *(lipî amelûti)*, or castor oil as ' the blood of a black snake ' *(dâmi ṣîri ṣalmi)* as the later alchemists were to give ridiculous synonyms for mercury, cinnabar, cadmia, and such."

It would be tempting to extend this quotation, but space forbids. We must restrict ourselves to indicating the contents of the Introduction :

1. Babylonian science; 2. Assyrian botany; 3. The animal kingdom; 4. The qualifications of the ancient Assyrians as chemists and geologists; 5. The materials of ancient glass; 6. A cuneiform glass-text of the seventeenth century B.C.; 7. The cuneiform glass-texts of the seventh century B.C.; 8. Recipes for making glass in Assyria in the seventh century B.C.; 9. The use of gold in glass (almost the Purple of Cassius), and the possibility of the knowledge of aqua regia among the Assyrians; 10. On the Assyrian geological methods; 11. The ZA-group of minerals, and the words for colour; 12. The magical use of colours; 13. Beads; 14. TAG. GAZ; 15. The methods of pounding and crushing stones and glass; 16. On the staining of stones; 17. The channels through which Babylonian knowledge reached the West.

Then follows the dictionary which is arranged in topical order :

1. The salts; 2. The chemical earths defined by SAHAR dust and IM ' clay '; 3. The drugs from the river; 4. The arsenic groups; 5-13. The metals; 14. The red stones; 15. The blue stones; 16. Ceruse, white lead, and red lead; 17. The white stones; 18. Marble, alabaster, gypsum, plaster, and lime; 19. The green stones; 20. Other minerals indicated by the prefix ZA.TU; 21. Stones used in carving and building; 22-105. Various minerals.

Then two appendices : 1. The glass receipts, 2. The Babylonian glass text ; Cuneiform syllabaries of minerals, and elaborate indices in sundry oriental languages.

We called this work the crown and climax of the author's investigations in Assyrian science ; it is also a foundation, and a very impressive one, for further investigations. The very availability of such a splendid tool will induce other scholars to complete and correct it. Dr. THOMPSON may be called the founder of a new branch of archaeology : Assyrian chemistry and geology. We hope that he may continue his own research long enough to provide himself important additions and corrections to this " bahnbrechend " dictionary.

GEORGE SARTON.

Keirin Taniyama. — *Nihon shakai jigyô dai-nenpyô* (Chronology of Social Service Works in Japan) 22, 306 p. Tokyo, Tôkô shoin, 1936. (Yen 5).

With the introduction of industrial society, some form of organized charities was necessary, and in 1908 under the auspieces of the Depart-

ment of Home Affairs, *Chûo Shakai Jigyô Kyokai* [Central Social Service Association] was organized, and it is divided into three main divisions : General Office; Institute of Social Service devoted to the research on social problems; Associated Charities. The present work was sponsered by the Institute of Social Service, under the supervision of Dr. YOSHITERU YABUKI, for the purpose of a survey of the background of Japanese social work. Since the introduction of Western methods, there had been a tendency to ape foolishly the new and ignore the old with centuries of tradition. Especially was this true in the organized social service work, and the purpose of the Institute in publishing this survey is to give a comprehensive view of what had been done to cure social evils in chronological order so that in future we can work out some more effective means of preventive methods.

The chronology begins with the age of myths. Already the main inland was divided up into dry and irrigated farm lands, and men were taught to cultivate grains, build boats with timber. They were also taught a method of afforestation to prevent erosion, control of epidemics by means of herb medicine and hot bath as preventive medicine, rituals to ward off evil spirits as well as natural calamities. By 86 B.C. a systematic irrigation began, and in 3 B.C. granaries were established throughout the provinces. In 61 A.D. an official was sent to *Tokoyo no kuni*, probably the modern Ryukyu Islands, to obtain organge trees. System of taxation, slave trade, census, treatment of the criminals, in fact any information which the students of Japanese social history wish to have is there with the source clearly indicated.

It is interesting to note that the front end paper reproduces an old graphic map of the Gokurakuji Temple compound, founded in 1259, showing a free dispensary of herb medicines, a free clinic, medicinal bath house, a sanitarium for lepers, a hospital for horses, etc. The back end paper reproduces a scene from the 19th century social history of distribution of fuel and provisions.

(Library of Congress) SHIO SAKANISHI

Kinnosuke Ogura. — *Sûgaku-shi kenkyû* (Studies in the history of mathematics : Series 1) 10, 340 p. illus. Tokyo, Iwanami shoten, 1935. (Yen 2.30).

Dr. OGURA, director of the Shiomi Research Institute of Physics and Chemistry and lecturer on the history of mathematics at Osaka Imperial University, is known as an authority in Far Eastern mathematical history through his various articles and more recently by his *Sûgaku kyôiku shi* [History of mathematical education]. The present volume is a collection of his essays centered around the origin and development of mathematical

concepts in various countries, and in the forthcoming second series the author hopes to collect more specialized studies and research problems.

The book is divided into three main sections : (1) A survey of mathematical history; (2) A cross-section of the Western mathematical history; (3) A cross-section of the Far Eastern mathematical history. In the first article, the author discusses briefly how the changing structure of society affects such an abstract science as mathematics. Scientific technique and economic problems affect it more than any one factor, and its development ranges from extreme abstraction to the most practical applications. The East Indian and Arabian contributions are significantly summed up.

In the second section as in the third, the author attempts to see how various social trends and tendencies are reflected in the contemporary treatises on arithmetics. Dr. OGURA takes England and France as the most typical examples and traces the various developments in their colonization and trade expansion.

The third section commences with an essay : Social nature of the Chinese mathematics, and the author takes the *Chin Chang Suan Shu* [Arithmetic in nine chapters]. Neither the author nor the date of composition is known, but without doubt it originated in the Chin period (246-207 B.C.) and was revised and annotated by successive masters till the close of the third century after Christ. It is a mathematical as well as a social history of five hundred years, and deals with such problems as land survey of crops of grain; public works such as construction of bridges, dikes, and irrigation; rates of exchange of food stuff; weights and measures; prices of various commodities; interest; tax and transportation charges; tariffs dividing objects according to official ranks. The author illustrates each section with a typical problem quoted from the treatise.

The remaining articles are devoted to (1) the internationalization of mathematical science in the Orient. The unique characteristics of the Chinese and Japanese mathematics are lost and in this branch of science the linguistic barrier ceases to exist. Article No. (2) deals very briefly with the changes that occured in the Japanese mathematics due to their contact with the West, while the third and last article is on the changing phases of mathematical education in Japan. Since I expect to review Dr. OGURA's book devoted entirely to this subject at a later date, I shall not go into this section in detail.

(Library of Congress) SHIO SAKANISHI

Catalogus codicum astrologorum graecorum.—Codices rossicos descripsit MSTISLAV ANTONINI F. ŠANGIN. Adiuvante Instituto historiae scientiarum et artium technicarum academiae scientiarum URSS. Tomus XII. viii + 268 p., 6 pl. Bruxelles, LAMERTIN, 1936 (12 Belgas).

The publication of this fundamental catalogue began under the general editorship of FRANZ CUMONT in 1898. For a list of parts I to VIII see *Isis* 6, 206. Part IX devoted to Britannic and Scandinavian MSS. is still on the stocks. Part X on the Athenian MSS. (1924) was dealt with in *Isis* 15, 295, Part XI in two volumes, *Codices Hispanienses*, edited by the late CARLO ORESTE ZURETTI (1865-1931) appeared in 1932 and 1934. This was not reviewed in *Isis* but we had opportunities of speaking of ZURETTI's contributions to a germane undertaking, the Catalogue of Greek alchemical MSS., namely his edition of the *De arte metallica seu de metallorum conversione in aurum et argentum* (1930, *Isis* 15, 410) and his *Alchemistica signa* (1932, *Isis* 19, 440) and to refer to various other papers of his on Greek alchemy. His catalogue of the Greek astrological MSS. of Spain covers more than five hundred pages.

The present volume, twelfth of the series (but eleventh in order of publication) is devoted to the Greek astrological MSS. preserved in Russian libraries. Its contents are very well described in the Preface, which it will suffice to reproduce:

"In hoc tomo Catalogi codices Petropolitani ex variis bibliothecis et Mosquenses, praecipue ab ARSENIO SUCHANOV ex Athus Montis monasteriis anno 1655 asportati, describuntur. Post editionem codicum Italicorum, Parisinorum, Germanicorum, Vindobonensium, Atheniensium, Hispaniensium non opus est, ut videtur, verbis confirmare quantam vim opera astrologica non solum ad philologiam, sed etiam ad scientiarum historiam exstruendam praebeant; superest fortasse dicere, quid in cognoscenda scientiarum popularium evolutione valeant. Libri manuscripti saec. XV ex.-XIX tractatusplerum que sine auctorum nomine traditos continent; qui cum recentiores sint, quaestioni profundae et gravi materiam dant; contextus ipse in litteris popularibus ad antiquitatem classicam ascendit, simulque universalitatem scientiae popularis per intellectuale commercium cum orientale, tum occidentale ostendit. Disciplinarum vero popularium astrologia, quae omnes scientias, meteorologiam, medicinam, botanicam, incantationes magicas etc. in alveo suo concludit, ceteris praeponebatur. Praxis etiam astrologica hic adnotanda est, quae dinavitionibus mathematicis per numerum-substantiam rerum et invocationem daemoniacam (daemones enim numerum demonstrant et respondent) utitur; ideo in appendice non meri tantum astrologici tractatus, sed etiam exempla astro-magica, divinationes mathematicae etc. eduntur. Ad calcem appendicis specimen astrologiae Rossicae, ex Graecis fontibus derivatae, multa vestigia scriptorum Graecorum deperditorum servantis publicantur. Additur quoque descriptio manuscripti astrologici Latini opuscula ex Arabico sermone translata continentis. Codicibus Rossicis nunc absolutis, imprimis Prof. FR.

CUMONT, qui et hanc descriptionem non solum in Catalogum Codicum astrologorum Graecorum inclusit, sed etiam plagulas omnes perlegit, multaque cum codicibus Romanis et editionibus contulit, Proff. I. J. KRAČKOVSKJ et V. I. VERNADSKJ, qui incepto nostro in Commissione academica de scientiarum historia, nunc Instituto historiae scientiarum et artium technicarum, liberalissime faverunt, et adiutores studii nostri Proff. N. P. LICHAČEV, A. J. MALEIN, I. A. BYČKOV gratissimo animo prosequimur."

The Latin ms. mentioned above, as containing treatises translated from the Arabic, was written in Spain in the thirteenth and fourteenth centuries ; it is now preserved in the library of the Academy of sciences in Leningrad. It contains texts (see pp. 205-10) ascribed to AL-FARGHĀNĪ, THĀBIT IBN QURRA, GEORGE the philosopher (fl. XIth cent.), AL-QABĪṢĪ, MĀSHĀLLĀH, ISḤĀQ AL-ISRĀ'ĪLĪ, ABŪ MA'SHAR, etc. Two long extracts are quoted : *Epistola* MASHALLAH *in pluviis et ventis* (pp. 210-16), GERGIS PHILOSOPHUS, *Liber de astronomiae disciplinae peritia* (pp. 216-29).

The book is completed with elaborate indices and 6 plates, representing astrological diagrams and symbols and one of them, colored images of astrological plants (Plantae Saturni, Iovis, Martis, Solis, Veneris, Mercurii et Lunae). That plate (no. 1) is taken from Cod. 3 of the palaeographic museum of Leningrad, a ms. written at Moscow in 1684-85.

GEORGE SARTON.

Ct. Lefebvre des Noettes.—*De la marine antique à la marine moderne. La révolution du gouvernail, contribution à l'histoire de l'esclavage.* MASSON et Cie, Paris, 1935.

In his earlier " contribution to the history of slavery " Commandant LEFEBVRE DES NOËTTES demonstrated, I think conclusively, that the basic problem of transportation, the utilization of animal power, remained insoluble to antiquity. (1) Only with three co-ordinate innovations,—the rigid horse collar, the metal horse shoe, and harnessing in file, all of which originated in the early Middle Ages,—only then did a successful exploitation of the chief source of power become possible. The maximum effective load which could be drawn by animals was limited throughout all antiquity to about one thousand pounds. For all heavier tasks, and they were many, human beings were harnessed. Whether M. LEFEBVRE DES NOËTTES is justified in his sweeping deduction of all human slavery from this basic root, is debatable. But he has certainly given an impressive demonstration of the interrelation of social and technical progress.

Shifting his attention from land to sea Commandant LEFEBVRE DES NOETTES has attempted a second scholarly coup of the same type. Using

(1) *L'attelage : le cheval de selle à travers les âges*, 2 vols. Paris, 1931. (*Isis* 19, 300). For other works by the same author see also *Isis* 10, 124, 278; 19, 283.

the same general method, a close study of archeological, documentary and pictorial sources, the author undertakes to show that the pivoting rudder, invented in the Middle Ages, inaugurated a revolution in the history of maritime transportation. Through that one fundamental improvement, he contends, the medieval navigators and ship-builders were enabled to outstrip the achievements of antiquity in an astonishingly short time. Larger vessels could be built and steered effectively; open sea traverses became possible, where formerly coastal sailing had been the rule, and the great age of maritime discovery could begin.

In one essential point the thesis of Commandant LEFEBVRE DES NOËTTES is doubtless correct. Ship-building and maritime transportation did advance rapidly in the twelfth and thirteenth centuries, and soon surpassed the point which antiquity had reached. Whether this remarkable development is the result of the rudder alone, is another question.

That the rudder pivoting on the stern-post was an invention of the Middle Ages (although anticipated in Egypt) seems to be a fact. Even GILFILLAN, who is anxious to minimize innovation, and reduce historical process to impersonal evolution, concedes rather grudgingly that the rudder was a "somewhat important invention." (2) Commandant LEFEBVRE DES NOËTTES is certainly exaggerating when he asserts that the subject has been totally neglected. Moreover he appears to have over-emphasized the role which the rudder played in advancing the navigator's art. One recent critic casts serious doubts on the immediate advantage which it gave the helmsman, as compared with the lateral oar or paddle which was used for steering in ancient times. (3) Although steering is obviously of fundamental importance, it must be remembered that the sails contribute to it as well as the rudder. Indeed, improvement in rigging, and particularly the development of lateen sails and ships with two and three masts, must have been co-ordinate with the invention of the rudder, instead of derived from it. In his earlier work Commandant LEFEBVRE DES NOËTTES reached the conclusion that the revolution in animal transportation was the result of *three* interrelated inventions. It would seem that a similar approach to the problem of the ship would have yielded more satisfactory results. I must agree with Professor USHER that no single, simple explanation is adequate. A complete synthesis of the subject still remains to be made. One important aspect particularly calls for investigation, viz. the relation

(2) S. C. GILFILLAN, *Inventing the ship*. Chicago, 1935. (*Isis* 24, 450-53).

(3) G. LA ROËRIE, Les transformations du gouvernail, *Annales d'histoire économique et sociale*, No. 36, pp. 564-583. November 1935. In the same number there are other articles with references for those interested in following up the "problème LEFEBVRE DES NOETTES."

between improvements in navigation and the advance of cartography. With a few exceptions historians have generally regarded the famous charts of the Middle Ages, the *portolani*, as an independent creation of Italian or Catalan navigators, which owed little or nothing to classical antiquity. A German scholar, RICHARD UHDEN, has recently gone against this accepted view. (4) He assembles evidence from ancient writers to show that Greek and Roman navigators must have had some kind of charts, and that these were probably based on the same sort of data,—distances and directions,—as those of the Middle Ages. Dr. UHDEN introduces no radically new material, and his argument, though ingenious, merely establishes a permissive case. The question is much too complex for a mere review. I should like to suggest, however, that because the ancients may have possessed navigation charts, there is no necessity for supposing that they were either detailed or accurate as were the *portolani*. The Tabula Peutingeriana inspires no great confidence in the cartography of antiquity. Moreover if M. LEFEBVRE DES NOËTTES is correct in his basic contention, i.e. that the navigation of antiquity was far below the level of that of the Middle Ages, one might infer that highly developed sea charts were in fact unnecessary. It was only when rudder and rigging made possible the construction of larger and more manageable ships, and the compass a uniform exploitation of improved steering capacity, that accurate charts became either realizable or helpful.

Harvard University. DANA B. DURAND.

B. L. Bogayevski.—*History of technics.* Vol. I, Part I. The technics of the primitive communistic society. XII + 635 p., 361 fig., 10 maps. Transactions of the Institute for the history of science and technology, Series IV, Issue 1. Moscow and Leningrad, Academy of Sciences Press, 1936. (In Russian). Rbls. 22.50; cloth binding, 2.50.

" Business," one of the words characteristic of modern America, has no equivalent in the Russian language; similarly, " tekhnika," one of the favorite words in the modern Russian language, patterned after the German word " Technik," has no one-word counterpart in English. The word " tekhnika " is used three times on the Russian title page; on the English title page, from which the above titles of the work, of Part I of Vol. I, and of the Transactions were copied, the word " tekhnika " is rendered twice, somewhat clumsily, by the word

(4) RICHARD UHDEN, Die antiken Grundlagen der mittelalterlichen Seekarten, *Imago Mundi*, I, pp. 1-20. Berlin, 1935.

"technics," and once, with a fair degree of approximation, by the word "technology." It might be noticed, incidentally, that the Russian title of the Institute avoids the word "tekhnologiya," and that the volumes of the Transactions seen by the reviewer seem to justify his impression that "Institute for the history of arts and sciences" would be a more appropriate English translation of the Russian title of the Institute.

Turning from the Transactions to the "History of technics," we find that "History of technology" would have been a more satisfactory English title of the work as a whole, since the forthcoming volumes will deal with the technical arts on higher levels of development. A title like "The technical arts of the primitive communistic society" is a satisfactory label for the subject matter of Part I of Vol. I. This subject matter was compiled, with the collaboration of V. I. GROMOV, B. F. ZEMLYAKOV, S. N. ZAMYATIN, P. I. BORISKOVSKI, and A. J. TIMOSHENKO, from books and papers on anthropology, prehistory, archaeology, etc. This familiar material is now presented in a new way: the author arranged it so as to offer to the readers a perspective view of the development of the social and economic institutions of mankind, from the pithecanthropus to the "threshold of civilization".

The large amount of information offered by the 517 pages of the text, and by the 361 figures in the text, is made available for reference by the numerous and carefully edited appendices and indices which occupy 115 pages. The classified bibliography, compiled with the cooperation of O. A. MAGNUS, contains 788 numbered items; there is a source index for the 361 figures, annotated and edited with loving care; the explanations of the maps and tables form a series of signed notes, with additional bibliographies; there are, of course, subject and name indices, as well as an elaborate analytical table of contents. N. BUKHARIN contributed a preface. The proofreading was done with great care.

A. P.

Jan Huizinga. — *In the shadow of to-morrow. A diagnosis of the spiritual distemper of our time.* Translated from the Dutch by J. H. HUIZINGA. ix + 218 p. London, HEINEMANN, 1936 (7/6), New York, W. W. NORTON, 1936 ($ 2.50).

Though only a small part of this book concerns directly the historian of science, his attention should be drawn to it for it is an excellent analysis of the social crisis which we are passing through, and chiefly of its intellectual causes and implications. The picture of our present world vigorously drawn by the author is black enough. He makes us realize more keenly than ever that our world is sick, very sick, — and yet his

vision is not one of despair, but rather of hope. He would say with St. Bernard "*Habet mundus iste noctes suas et non paucas.*" There are black interludes, and the one which we are witnessing is one of the blackest, yet there is no reason for assuming that this night will not be followed by another day. To quote his own words (p. 1) :

"Everywhere there are doubts as to the solidity of our social structure, vague fears of the imminent future, a feeling that our civilization is on the way to ruin. They are not merely the shapeless anxieties which beset us in the small hours of the night when the flame of life burns low. They are considered expectations founded on observation and judgment of an overwhelming multitude of facts. How to avoid the recognition that almost all things which once seemed sacred and immutable have now become unsettled, truth and humanity, justice and reason? We see forms of government no longer capable of functioning, production systems on the verge of collapse, social forces gone wild with power. The roaring engine of this tremendous time seems to be heading for a breakdown. But immediately the antithesis forces itself on our minds. Never has there been a time when men were so clearly conscious of their commanding duty to co-operate in the task of preserving and improving the world's well-being and human civilization. At no time has work been as much honoured as it is to-day. Man was never so ready to apply his full courage and all his powers to a common cause."

One of the most hopeful symptoms of the present conditions is our very consciousness of sickness and evil, which may lead us back to sanity and health in the fullness of time.

I shall not attempt to summarize a book so rich in experience and wisdom, but only offer a few remarks. I was very much interested in the denunciation of Pragmatism (p. 82) as one of the roots of our intellectual and moral degenerescence. A deeper cause of fall, upon which the author insists repeatedly, is the lack of a metaphysical aim uniting the people. For example, he says (p. 34) :

"One hears a great deal to-day of "national cultures" and "class cultures," that is to say, the concept culture is made subservient to the power, prosperity, or security ideal of a particular group. Those doing so, however, deprive the concept of all its real meaning; for they forget the paradoxical but, in view of the foregoing, inescapable conclusion that one can only speak of culture when the ideal dominating it transgresses the interests of the community claiming the possession of culture. Culture must have its ultimate aim in the metaphysical or it will cease to be culture."

This is true, but how could one give the people the metaphysical unity which they lack? Such unity may possibly develop, it cannot be deliberately created. Religion — organized religion — is regressing everywhere, at the very time when it is most needed; it is being perverted or contaminated by irrelevant elements at the very time when it should be purer than ever.

The chapters on science are very good indeed, and this is the more remarkable because Prof. HUIZINGA is not a man of science. After a clear diagnosis of the scientific crisis, he concludes (p. 50):

"The ascertainment of this simple fact that at least in one highly important field the course is inalterably set, should afford comfort and strength to those who would despair of the future of our culture. The crisis of scientific thinking may be bewildering in the highest degree; a reason for despondency it will be only to those who have not the courage to accept this world and this life as they have been given to us."

According to him, there are thus more reasons for hope and less for fear in the purely scientific activities (bewildering as they may be) than in any other human activities. It is good to hear such words from the lips of a man of letters.

While he insists on the need of a metaphysical aim, he realizes that our greatest dangers are due to the growth of superstition and irrationalism, especially in the field of politics.

"Barbarisation sets in," he remarks (p. 195), "when, in an old culture which once, in the course of many centuries, had raised itself to purity and clarity of thought and understanding, the vapours of the magic and fantastic rise up again from the seething brew of passions to cloud the understanding; when the *muthos* supplants the *logos*."

It is a great pity, by the way, that this book will hardly be available in the countries where national hallucinations are cultivated with the greatest intensity, and where its reading would be most profitable.

The final chapter on *katharsis* insists on the need of *individual* purification, an idea which we developed repeatedly in the prefaces and reviews of *Isis*. I share the author's optimism concerning the essential soundness of the people and especially of the young. What they need most is disinterested guidance, and the most difficult problem of all is to insure the harmonization and convergence of their endeavours. That is too big a question to be discussed here and now, but we shall return to it later.

The author of this stimulating book, JAN HUIZINGA, was born in Groningen in 1872; he studied at the universities of Groningen and Leipzig. He is professor of history in the University of Leiden and in the Technical Institute of Delft. He has written many valuable books the best known of which are his *Herfsttij der Middeleeuwen* (1919, 3rd. ed. 1928) and his *Erasmus* (1924). The *Waning of the Middle Ages* was translated into English, French, Spanish, and Swedish. It is one of the best books on mediaeval thought available to-day. Professor HUIZINGA is one of the leading humanists of our time.

S. S. Carinthia, August 14, 1936. GEORGE SARTON

Forty-eighth Critical Bibliography

of the

History and Philosophy of Science and of the History of Civilization

(*to end of September* 1936—*with special reference to Iran and Islam*)

This forty-eighth Bibliography contains about 695 items of which 105 deal with Iran and Islam. They have been kindly contributed by the nine following scholars belonging to four different countries:
C. W. ADAMS (Hertford, England) A. POGO (Washington, D. C.)
M. F. ASHLEY-MONTAGU (New York) GEORGE SARTON (Cambridge, Mass.)
W. BURKE-GAFFNEY (S. J.) (Toronto) LYNN THORNDIKE (New York)
C. A. KOFOID (Berkeley, Cal.) M. C. WELBORN (Cambridge, Mass.)
J. PELSENEER (Brussels).

This Bibliography includes as usual a series of addenda and errata to SARTON's *Introduction to the History of Science*, vols. 1 and 2 (Baltimore and London, 1927 and 1931). Its purpose and methods have been explained in the preface to the 38th Critical Bibliography (*Isis* 20, 506-08).

The sections on Iran and Islam are especially full, as I have liquidated as much as I could of my stock of notes concerning them.

Many notes of this forty-eighth bibliography were collected by me this summer in the rich library of Dr. ARNOLD C. KLEBS, at Nyon (Switzerland), whose hospitality and friendliness are deeply appreciated.

I have in my drawers a large number of notes which I will be glad to publish as soon as I have been able to check them upon the originals.

I entreat the authors of relevant books and papers to send me copies of them *as promptly as possible* in order that their studies may be registered in this bibliography and eventually reviewed and discussed. By so doing they will not simply help me and every other historian of science but they will help themselves in the best manner for they will obtain for their work the most valuable publicity and its certain incorporation into the literature of the subject.

Many of the notes were checked and the final manuscript and proofs of this Critical Bibliography were kindly read by Dr. M. C. WELBORN.

Harvard Library, 185 GEORGE SARTON.
Cambridge, Mass. *October 1, 1936.*

PART I

FUNDAMENTAL CLASSIFICATION (CENTURIAL)

VIth Century B.C.

Johnston, Joseph. SOLON's reform of weights and measures. *Journal of Hellenic studies* 54, 180-84, 1934. ISIS

Rougier, Louis. L'origine astronomique de la croyance pythagoricienne en l'immortalité céleste des âmes. viii + 144p. (*Recherches d'archéologie, de philologie et d'histoire*, 6). Le Caire, Institut français d'archéologie orientale, 1933. ISIS

" Nous nous proposons de montrer que, jusqu'à plus ample informé, les Pythagoriciens n'ont pas été les propagateurs, mais les auteurs originaux de leur propre croyance en l'immortalité céleste de l'âme. Cette croyance repose chez eux, sur trois affirmations préalables : 1. La dualité du monde. 2. La divinité des astres. 3. La parenté des âmes et des astres. Or, si les deux premières affirmations furent formulées par les Babyloniens, la troisième se présente comme la conséquence d'une découverte astronomique de PYTHAGORE et de son École, qui allait substituer à l'astronomie empirique des Orientaux l'astronomie explicative des géomètres grecs."

Sarton, George. Chinese glass at the beginning of the Confucian age. *Isis* 25, 73-9, 1 fig., 1936. ISIS

The " unpublished report " communicated to the author and referred to on p. 78 was prepared by HORACE C. BECK with regard to the specimens exhibited in London 1934. The results embodied in this report were obtained in the course of a research on ancient Chinese glass on which H. C. BECK and C. G. SELIGMAN have been engaged for some years; a précis of their first paper on the subject will be found in the *Proceedings of the First International Congress of prehistoric and protohistoric sciences*, London, 1932 (Oxford University Press, 1934) pages 258-59, and they read another paper at the Congress at Oslo." G. S.

Stadelmann, Heinrich. Die Biologie des LAOTSE. 21 p. Kampen, Sylt, KAMPMANN (n.d.). ISIS

Vth Century B.C.

Baissette. Gaston. HIPPOCRATE. Paris, GRASSET, 1931. ISIS

Written as a thesis, *Aux sources de la médecine. Vie et doctrine d'Hippocrate* (Paris 1931). German translation 1932; Italian one 1933.

Becker, Oskar. Zur Textgestaltung des endemischen Berichts über die Quadratur der Möndchen durch HIPPOKRATES von Chios. *Quell. u. Stud. zur Gesch. d. Math., Astro. u. Phy.*, Abtg. B: Studien 3, 411-19, 2 fig., 1936. ISIS

Friedländer, Paul; Birtner, Herbert. PINDAR oder KIRCHER? *Hermes* 70, 463-75, 1935. ISIS

Another article on a much discussed subject. For previous articles by FRIEDLÄNDER, and also by A. ROME, and others, see *Isis* 25, p. 178, 214. M. C. W.

Lewek, Werner R. Die Bank des HIPPOKRATES. Ein Beitrag zur Geschichte der Behandlung von Frakturen und Luxationen. *Janus* 40, 65-84, 1936. ISIS

Lewek, Werner R. Die Hals-Nasen-Ohren-Krankheiten in der Sammlung der Hippokratischen Schriften. *Folia Oto-laryngologica orientalia* 2, 250-303, 1936. ISIS

Van Gils, J. B. F. HIPPOCRATES op bezoek bij DEMOCRITUS. *Bijdragen tot de geschiedenis der geneeskunde* 16, 115, 2 fig., 1936. ISIS

IVth Century B.C. (whole and first half)

Becker, Oskar. EUDOXOS-Studien III. Spuren eines Stetigkeitsaxioms in der Art des Dedekind'schen zur Zeit des EUDOXOS. IV. Das Prinzip des ausgeschlossenen Dritten in der griechischen Mathematik. V. Die eudoxische Lehre von den Ideen und den Farben. *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abteilung B: Studien 3, 236-44, 370-411, 1936. ISIS

IVth Century B.C. (second half)

Boričevskij, I. A. DEMOKRIT und EPIKUR im Kampf um die Grundlagen des Atomismus. *Archives of the history of science and technology* 8, 111-36, 1936 (in Russian with German summary). ISIS

Einarson, Benedict. On certain mathematical terms in ARISTOTLE's *Logic*. *Amer. J. of philol.* 57, 33-54, 151-72, 1936. ISIS

Rawlinson, H. G. India and Greece. *Indian art and letters* 10, 57-8, 1936. ISIS

Apropos of a statement ascribed to ARISTOXENOS the musician by EUSEBIOS. "So we have contemporary evidence of the presence in Athens as early as the fourth century of Indians who knew Greek and actually discussed philosophy with SOCRATES. This must modify our views of the interrelationship of Hellenic and Hindu culture." G. S.

Schlayer, Karl. Wie lautete das Aristotelische Fallgesetz? Beitrag zur Lösung einer problemgeschichtlichen Streitfrage. *Quell. u. Stud. z. Gesch. d. Math., Astron. u. Phys.*, Abtg. B: Studien 3, 420-33, 1936. ISIS

Senn, G. Die Entwicklung der biologischen Forschungsmethode in der Antike und ihre grundsätzliche Förderung durch THEOPHRAST VON ERESOS (*Veröff. der schweizerischen Gesellschaft für Gesch. d. Medizin* nº 8). Aarau 1933. ISIS

Ist Century B.C. (whole and first half)

Gaffiot, Félix. Note sur CICÉRON traducteur du Grec. *Revue des études grecques* 47, 21-5, 1934. ISIS

Natanson, Wladyslaw. De rerum natura. 31 p. Odbitka z *Przeglądu Wspólczesnego* Nr. 107, Marzec 1931 (in Polish). ISIS

Ist Century B.C. (second half)

Granger, Frank. The provenience of the London VITRUVIUS. *Speculum* 11, 261-64, 1936. ISIS

Trendelenburg, Adolf. VIRGILS "Zurück zur Natur!". *Archiv f. Gesch. d. Math. d. Naturw. u. d. Techn.* 13, 434-43, 1931. ISIS

Ver Eecke, Paul. Le traité du métrage des divers bois de DIDYME D'ALEXANDRIE. Traduit pour la première fois du grec en français avec des notes continuelles. *Annales de la société scientifique de Bruxelles* 56, série A, 6-16, 1936. ISIS

"DIDYME D'ALEXANDRIE est rangé parmi les mathématiciens grecs mineurs, et la critique moderne le fait vivre au commencement du premier siècle de notre ère. Il nous a transmis un court traité, ou plutôt un fragment d'écrit sur le métrage des bois, comportant, outre les données métrologiques en

usage à son époque et les règles de leurs transformations unitaires et divisionnaires, une série de solutions de petits problèmes concrets appliqués à des pièces de bois de diverses formes. Ce petit ouvrage, mis au jour par le Cardinal ANGELO MAÏ, fut édité pour la première fois en 1819, d'après un manuscrit de la Bibliothèque de Milan, conjointement avec d'autres écrits de métrétique ancienne. Il fut publié une seconde fois par F. HULTSCH, en 1864, dans sa collection des écrits héroniens de Géométrie et de Stéréométrie. Ces deux éditions étant encore entachées de certaines leçons fautives des manuscrits consultés, une dernière édition a été donnée par le grand helléniste J. L. HEIBERG, en 1927, basée sur la recension des cinq manuscrits connus jusqu'ici. C'est d'après cette édition excellente, qui a levé presque toutes les obscurités du texte, que nous avons élaboré une première traduction française, absolument littérale, et accompagnée de notes continuelles, dans le but de mettre l'ouvrage de DIDYME à la disposition documentaire de ceux qui, peu familiarisés avec les textes grecs, s'intéressent à la métrologie considérée parmi les premiers éléments de civilisation de l'humanité."

IInd Century (second half)

Henne, Henri. La géographie de l'Egypte dans XÉNOPHON D'EPHÈSE. *Revue d'histoire de la philosophie et d'histoire générale de la civilisation* 14, 97-106, 1936. ISIS

Temkin, Owsei; Temkin, C. Lilian. Some extracts from GALEN's "Anatomical procedures." Translated. *Bulletin of the institute of the history of medicine* 4, 466-76, 1936. ISIS

IIIrd Century (second half)

Diophantos (Addition to *Introd.* 1, 336 and correction to *Isis* 21, 250). Says PAUL VER EECKE in his *Diophante* (Bruges 1926, p. lxxv): "Un autre ouvrage qui vint vulgariser les œuvres de DIOPHANTE après la version latine de XYLANDER est celui que SIMON STEVIN publia en français, en 1585, sous le titre: *L'Arithmétique...; Contenant les computations des nombres Arithmétiques ou vulgaires: Aussi l'Algèbre, avec les équations des cinc quantitez. Ensemble les quatre premiers livres d'Algèbre de Diophante d'Alexandrie, maintenant premièrement traduicts en François.*"... "Contrairement à ce que semble indiquer le titre de la partie de l'ouvrage se rapportant à DIOPHANTE, elle est loin de constituer une première traduction française véritable de l'auteur grec. Elle ne contient en réalité que de simples adaptations de 81 propositions des quatre premiers livres de DIOPHANTE dans les notations algébriques appliquées par STEVIN dans tout le reste de son ouvrage. Ces adaptations présentent

beaucoup d'analogie avec celles de RAPHAËL BOMBELLI ; et l'on peut croire qu'il s'est assez largement inspiré de la manière de ce célèbre algébriste italien, car il le cite avec CARDAN, LOUIS DE FERRARE et TARTAGLIA, parmi les ' inventeurs de règle de trois des quantitez,' et le qualifie de ' grand mathématicien de notre temps.' Au reste, STEVIN ne base nullement son travail sur le texte grec de DIOPHANTE, lequel n'avait du reste pas encore été édité, et dont il ne paraît avoir eu aucun manuscrit à sa disposition. Il ne suit pas davantage à la lettre la version latine de XYLANDER, et il se borne à n'en donner que le sens. Il énonce les propositions de DIOPHANTE d'une manière fort libre, et change fréquemment leurs données numériques, notamment de toutes celles du premier livre, en sorte que leurs solutions aboutissent à des valeurs autres que celles obtenues par l'auteur grec." ISIS

Ver Eecke, Paul. PAPPUS D'ALEXANDRIE. La collection mathématique. Œuvre traduite pour la première fois du grec en français, avec une introduction et des notes. 2 vols., cxxvi + 883 p., figs. Paris, DESCLÉE DE BROUWER, 1933. ISIS

Traduction *littérale* de la Collection de PAPPUS (la première en langue vulgaire) établie sur le texte de l'édition critique de F. HULTSCH (3 vols. Berlin 1875-78). L'auteur a ajouté une longue introduction (118 p.) qui contient tout ce que l'on sait sur PAPPUS, plus une analyse de son œuvre mathématique et astronomique. Il n'y a malheureusement ni tables ni index ni aucun moyen de s'orienter rapidement dans cette riche collection. G. S.

VIIIth Century (second half)

Kraus, Paul. JĀBIR IBN ḤAYYĀN. Essai sur l'histoire des idées scientifiques dans l'Islam. Volume I : Textes choisis. 8 + 560 p. en arabe. Paris, MAISONNEUVE ; Le Caire, Librairie El-Khandgi, 1935. (75 fr.) ISIS

" Ce travail est consacré à l'étude des ouvrages scientifiques qui passent dans la littérature arabe pour être l'œuvre de JĀBIR IBN ḤAYYĀN, élève de JA'FAR, sixième imām shī'ite... Déjà, dès 1893, O. HOUDAS avait publié et traduit, dans le cadre de *La Chimie au Moyen Age* de M. BERTHELOT, six traités de JĀBIR. Après lui, E.-J. HOLMYARD a repris le texte d'une édition lithographique de Bombay laquelle contenait onze petits opuscules de JĀBIR. Mais ces publications fortuites ne permettaient guère de juger des intentions véritables de l'auteur des écrits jabiriens. Après compulsation de tous les manuscrits jabiriens d'Eu rope, du Caire et d'Istanbul, nous avons décidé de donner des extraits c aractéristiques de chacune des parties du Corpus de ces écrits. Notre choix a été déterminé par l'exposé même

de la doctrine jabirienne lequel fera l'objet des deux volumes qui suivront. Notre recueil de textes comprendra, de ce fait, des écrits très différents par le caractère. Une grande partie en a été choisie en vue d'illustrer les aspects multiples de la science jabirienne." ... " Une autre partie de ce recueil comprendra des textes de caractère religieux, susceptibles de nous donner une idée des rapports de l'auteur du Corpus avec le mouvement de la Shī'a extrémiste." ... " Un intérêt particulier s'attache aux six chapitres du *kitāb al-khawāṣṣ* qui contiennent une réfutation de la métaphysique manichéenne du point de vue de la philosophie aristotélicienne. D'autres passages tirés du même livre donnent de l'auteur quelques notices autobiographiques et bibliographiques. Les deux volumes à paraître contiendront une traduction partielle des présents textes."

IXth Century (whole and first half)

Job of Edessa. Encyclopaedia of philosophical and natural sciences as taught in Baghdad about A.D. 817, or Book of treasures by JOB OF EDESSA. Syriac text edited and translated with a critical apparatus by A. MINGANA. xlviii + 470 p. (Vol. I of Woodbrooke scientific publications). Cambridge, HEFFER, 1935. ISIS

Reviewed by GEORGE SARTON, *Isis* 25, 141-44, 1936.

IXth Century (second half)

Mélandre, M. IEPA ou SCOT ERIGÈNE? *Archives d'histoire doctrinale et littéraire du moyen âge* 6, 277-86, 1931. ISIS

Ruska, Julius. Das Buch der Alaune und Salze. Ein Grundwerk der spätlateinischen Alchemie. Herausgegeben, übersetzt und erläutert. 127 p. Berlin, Verlag Chemie, 1935. ISIS

Reviewed by GEORGE SARTON, *Isis* 25, 144-45, 1936.

Xth Century (whole and first half)

Massignon, L. Notes sur le texte original arabe du " De intellectu " d'AL-FĀRĀBĪ. *Archives d'histoire doctrinale et littéraire du moyen âge* 4, 151-58, 1929. ISIS

Mez, Adam (1869-1917). El renacimiento del Islam. Traducción del Alemán por SALVADOR VILA. 641 p. Madrid, Imprenta de ESTANISLAO MAESTRE, 1936 (30 pesetas). ISIS

The original edition of this very important work: *Die Renaissance des Islam* (Heidelberg 1922) was reviewed by JULIUS RUSKA (*Isis* 5, 210). Readers

who are more familiar with Spanish than with German will be delighted to have this translation apparently prepared with great care and very well indexed. G. S.

Muckle, J. T. ISAAC ISRAELI's definition of truth. *Archives d'histoire doctrinale et littéraire du moyen âge* 8, 5-8, 1933. ISIS

Weinberg, Josef. Die Algebra des ABŪ KĀMIL ŠOGĀ' BEN ASLAM. 144 p. Munich, Selbstverlag, 1935. ISIS

Reviewed by SOLOMON GANDZ, *Isis* 25, 145-47, 1936.

XIth Century (whole and first half)

(al-Bīrūnī). Epitre de BĪRŪNĪ, contenant le répertoire des ouvrages de MUḤAMMAD B. ZAKARĪYĀ AR-RĀZĪ, publiée par PAUL KRAUS. 51 p. Paris, MAISONNEUVE, 1936. (15 frs.) ISIS

Arabic text of the unique Leiden MS. well known to our readers through J. RUSKA's translation " AL-BĪRŪNĪ als Quelle für das Leben und die Schriften AL-RĀZĪ's " (*Isis* 5, 26-50, 1923). G. S.

Creutz, Rudolf. Der Frühsalernitaner ALFANUS und sein bislang unbekannter " Liber de pulsibus." Zum Gedenken an die 850. Wiederkehr seines Todestages (7. Okt. 1085). *Archiv für Geschichte der Medizin* 29, 57-83, 1936. ISIS

Garcia Gomez, Emilio. Polemica religiosa entre IBN ḤAZM e IBN AL-NAGRĪLA. *Al-Andalus* 4, 1-28, 1936. ISIS

Gilson, Etienne. AVICENNE et le point de départ de DUNS SCOT. *Archives d'histoire doctrinale et littéraire du moyen âge* 2, 89-149, 1927. ISIS

Hoogterp, Pierre W. WARNERII BASILIENSIS *Paraclitus* et *Synodus*. *Archives d'histoire doctrinale et littéraire du moyen âge* 8, 261-429, 1933. ISIS

Idris, H. R. Contribution à l'histoire de l'Ifrikiya. Tableau de la vie intellectuelle et administrative à Kairouan sous les Aglabites et les Fatimites (4 premières siècles de l'Hégire), d'après le Riyāḍ en nufūs de ABŪ BAKR EL MĀLIKĪ. *Revue des études islamiques*, 105-77, 1935. ISIS

Ünver, A. Süheyl. EBURREYHAN DE BIROUN (HARZÉMI), médecin turc, et ses ouvrages médicaux (972-1048). *Türk tip tarihi arkivi*, cilt 1, no. 3, 1335, Istanbul 1935 (in Turkish and French). ISIS

Apropos of AL-BIRŪNĪ.

Yaltkaya, Şerefeddin. Un poème médical d'AVICENNE. *Türk tib tarihi arkivi*, vol. 1, 127-42, Istanbul 1935. (In Turkish with French summary). ISIS

XIth Century (second half)

Blachère, Régis. ṢĀ'ID AL-ANDALUSĪ : Kitāb ṭabaqāt al-umam (Livre des catégories des nations). Traduction avec notes et indices précédée d'une introduction. 192 p. (Publications de l'Institut des hautes études marocaines 28). Paris, LAROSE, 1935. ISIS

In the note on the *Ṭabaqāt al-umam* included in my *Introduction* (vol. 1, 776), I remarked that an English version was very desirable. We are given now a French version which will answer the same purpose. The author has used Father CHEIKHO's edition of 1911 and has referred to two Paris manuscripts. I read the whole text in Arabic during my residence in Beirūt and have no desire of rereading it in French. The work seems to have been done with great care and the author has added the necessary indices. He was already favorably known to Arabists by his geographical anthology (1932; *Isis* 24, 447-9). G. S.

Cohen, Harry A. RASHI on the minor prophets. *Jewish quarterly review* 27, 87-91, 1936. ISIS

Macdonald, D. B. The meanings of the philosophers, by AL-GHAZZĀLĪ. *Isis* 25, 9-15, 1936. ISIS

Apropos of the *Maqāṣid al-falāsifa* and of Rev. J. T. MUCKLE's publication (Toronto 1933). G. S.

XIIth Century (whole and first half)

Creutz, Rudolf. Die medizinisch-naturphilosophischen Aphorismen und Kommentare des Magister URSO SALERNITANUS nach handschriften lateinisch und deutsch hrsg. 192 p. (*Quellen und Studien zur Gesch. d. Naturw. u. d. Med.* 5). Berlin, SPRINGER, 1936 (Rm. 26.60). ISIS

Contents : 1. Zur Einführung von PAUL DIEPGEN; 2. Vorbemerkungen des Verfassers; 3. Der lateinische Text der Aphorismen; 4. URSO's Vorrede

zu den Glosulae; 5. Der lateinische Text der Glosulae; 6. Die deutsche Übertragung der Vorrede URSO's; 7. Die deutsche Übersetzung der Aphorismen und die auszügliche Übertragung der Glosulae.

My copy of this volume is available to a competent scholar willing to analyze it for *Isis*. G. S.

Huizinga, J. ABAELARD. Overdruk uit Handelingen en levensberichten van de maatschappij der nederlandsche letterkunde te Leiden, 66-82, 1934-35. ISIS

Voordracht gehouden op de Jaarvergadering van 12 Juni 1935.

XIIth Century (second half)

Huizinga, J. Über die Verknüpfung des poetischen mit dem theologischen bei ALANUS DE INSULIS. Mededeelingen der koninklijke akademie van wetenschappen, afdeeling letterkunde 74, 89-199, 1932. ISIS

Serouya, Henri. La philosophie de MAIMONIDE. *Revue d'histoire de la philosophie et d'histoire générale de la civilisation* 13, 23-54, 1936. ISIS

XIIIth Century (whole and first half)

Chenu, M.-D. La théologie comme science au XIII^e siècle. *Archives d'histoire doctrinale et littéraire du moyen âge* 2, 31-71, 1927. ISIS

Graff, Lucian. Forensische Medizin im Sachsenspiegel. *Archiv für Geschichte der Medizin* 29, 84-103, 1936. ISIS

Lacombe, G.; Smalley, Beryl; Gregory, Alys L. Studies on the commentaries of Cardinal STEPHEN LANGTON. *Archives d'histoire doctrinale et littéraire du moyen âge* 5, 5-266, 1930. ISIS

Mandonnet, P. Date de la mort de GUILLAUME D'AUXERRE (3 nov. 1231). *Archives d'histoire doctrinale et littéraire du moyen âge* 7, 39-46, 1932. ISIS

Rohmer, Jean. La théorie de l'abstraction dans l'école franciscaine d'ALEXANDRE DE HALÈS à JEAN PECKAM. *Archives d'histoire doctrinale et littéraire du moyen âge* 3, 105-84, 1928. ISIS

XIIIth Century (second half)

Bouyges, Maurice (S. J.). ROGER BACON a-t-il lu des livres arabes? *Archives d'histoire doctrinale et littéraire du moyen âge* 5, 311-15, 1930. ISIS

Carmody, Francis J. Latin sources of BRUNETTO LATINI's world history. *Speculum* 11, 359-70, 1936. ISIS

Chenu, M.-D. La première diffusion du Thomisme à Oxford. KLAPWELL et ses " notes " sur les sentences. *Archives d'histoire doctrinale et littéraire du moyen âge* 3, 185-200, 1928. ISIS

Edgar, J. H. The Chen t'an from " The local customs of the Cambodians " (A tentative translation). *Journal of the West China Border Society* 7, 61-3, 1935. ISIS

Apropos of CHOU TA-KUAN, q.v. my *Introduction* 2, 1067. G. S.

Feldhaus, Franz Maria. Über Herstellung und Abdrehen einer Metallkugel im Mittelalter. 388 p., 2 fig. Berlin, 1934. ISIS

In den Schriften von ALFONS X, wird um 1256 gezeigt, wie man einen Globus aus Metall anfertigen und auf der Drehbank abdrehen soll.

Festugière, A. M. La place du " De anima " dans le système aristotélicien d'après SAINT THOMAS. *Archives d'histoire doctrinale et littéraire du moyen âge* 6, 25-47, 1931. ISIS

Gilson, Etienne. Pourquoi SAINT THOMAS a critiqué SAINT AUGUSTIN. *Archives d'histoire doctrinale et littéraire du moyen âge* 1, 6-127, 1926-7. ISIS

Grabmann, Martin. Die *Opuscula de Summo Bono sive De vita philosophi* und *De sompniis* des BOETIUS VON DACIEN. *Archives d'histoire doctrinale et littéraire du moyen âge* 6, 287-317, 1931. ISIS

Guillet, J. La " lumière intellectuelle " d'après S. THOMAS. *Archives d'histoire doctrinale et littéraire du moyen âge* 2, 79-88, 1927. ISIS

Haddad, Sami I.; Khairallah, Amin A. A forgotten chapter in the history of the circulation of the blood. *Annals of surgery* 104, 8 p., 1936. ISIS

Apropos of IBN AL-NAFĪS. With facsimiles of MSS. The same subject had been dealt with by MEYERHOF in *Isis* 23, 100-20, 1935.

Koch, J. JACOB VON METZ, O. P., der Lehrer des DURANDUS S. PORCIANO, O. P. *Archives d'histoire doctrinale et littéraire du moyen âge* 4, 169-232, 1929. ISIS

Longpré, Ephrem. Questions inédites du commentaire sur les *Sentences* de GAUTHIER DE BRUGES. *Archives d'histoire doctrinale et littéraire du moyen âge* 7, 251-75, 1932. ISIS

Longpré, Ephrem. THOMAS D'YORK et MATTHIEU D'AQUASPARTA. Textes inédits sur le problème de la création. *Archives d'histoire doctrinale et littéraire du moyen âge* 1, 269-308, 1926-27. ISIS

Mandonnet, P. ALBERT LE GRAND et les Economiques d'ARISTOTE. *Archives d'histoire doctrinale et littéraire du moyen âge* 8, 29-36, 1933. ISIS

Mandonnet, P. GUILLAUME DE MOERBEKE, traducteur des Economiques (1267). *Archives d'histoire doctrinale et littéraire du moyen âge* 8, 9-29, 1933. ISIS

Roland-Gosselin, M. D. Sur la double rédaction par ALBERT LE GRAND de sa dispute contre AVERROÈS *De unitate intellectus* et *Summa theologiae* II tr. XIII, Q. 77, m. 3. *Archives d'histoire doctrinale et littéraire du moyen âge* 1, 309-12, 1926-27. ISIS

Salman, D. SAINT THOMAS et les traductions latines des *Métaphysiques* d'ARISTOTE. *Archives d'histoire doctrinale et littéraire du moyen âge* 7, 85-120, 1932. ISIS

Simonin, H. D. Autour de la solution thomiste du problème de l'amour. *Archives d'histoire doctrinale et littéraire du moyen âge* 6, 174-274, 1931. ISIS

Simonin, H. D. Les "Summulae logicales" de PETRUS HISPANUS. *Archives d'histoire doctrinale et littéraire du moyen âge* 5, 267-78, 1930. ISIS

Thaer, Clemens. Die EUKLID-Überlieferung durch AṬ-ṬŪSĪ. *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abteilung B: Studien 3, 116-21, 1936. ISIS

Théry, G. Le manuscrit Vat. grec. 370 et SAINT THOMAS D'AQUIN. *Archives d'histoire doctrinale et littéraire du moyen âge* 6, 5-23, 1931. ISIS

XIVth Century (whole and first half)

Boffito, Giuseppe. La circolazione del sangue secondo CECCO D'ASCOLI e DANTE ALIGHIERI. 20 p. Pubblicazioni del Collegio alla Querce di Firenze, 1932. ISIS

Boffito, Giuseppe. Le quattro " chiare " stelle di DANTE. Appendice al saggio di commento scientifico della " Divina commedia." 6 p. Pubblicazioni dell'Osservatorio del Collegio alla Querce (Firenze), nº 62, 1936. ISIS

Boffito, Giuseppe. Saggio d'un commento scientifico alla *Divina commedia*. 23 p., frontispiece. Firenze, Tipografia Giuntina, 1936. ISIS

Coomaraswamy, Ananda K. Two passages in DANTE's *Paradiso*. *Speculum* 11, 327-38, 1936. ISIS

Delorme, F. Le cardinal VITAL DU FOUR, huit questions disputées sur le problème de la connaissance. *Revue d'histoire doctrinale et littéraire du moyen âge* 2, 151-337, 1927. ISIS

Françon, Marcel. PETRARCH, disciple of HERACLITUS. *Speculum* 11, 265-71, 1936. ISIS

Matthews, Charles D. A Muslim iconoclast (IBN TAYMĪYYEH) on the " merits " of Jerusalem and Palestine. *Journal of the American oriental society* 56, 1-21, 1936. ISIS

Millás Vallicrosa, J. Un almanaque portugués del siglo XIV. 7 p. Extracto de la Actas del III Congreso internacional de historia de las ciencias, celebrado en Portugal en 1934). Lisboa, 1935. ISIS

Reviewed by A. G. P., *Al-Andalus* 4, 235, 1936.

Oltmanns, Käte. Meister ECKHART. 213 p. (Philos. Abh., 2). Frankfurt a.M., KLOSTERMANN, 1935. ISIS

Reviewed by ERNST REFFKE, *DLZ* 57, 693-96, 1936.

Piesch, Herma. Meister ECKHARTS Ethik. Mit einem Vorwort von OTTO KARRER. XV + 183 p. Luzern, Vita Nova Verl., 1935. ISIS

Reviewed by ERNST REFFKE, *DLZ* 57, 693-96, 1936.

Renaud, H. P. J. Un chirurgien musulman du royaume de Grenade : MUḤAMMAD AŠ-ŠAFRA. *Hespéris*, 20, 20 p., 1935. ISIS

This is the first study devoted to the Hispano-Muslim physician, ABŪ 'ABDALLĀH MUḤAMMAD IBN 'ALĪ AL-QIRBILYĀNI (i.e., of Crevillente, near Elche) AL-SHAFRA who flourished in Granada and in Cadiz in the beginning of the fourteenth century. Analysis of his work *Kitāb al-istiqṣā wal-ibrām fi 'ilāj al-jirāḥāt wal-awrām*. G. S.

Salvemini, Gaetano. Florence in the time of DANTE. *Speculum* 11, 317-26, 1936. ISIS

Théry, G. Le commentaire de Maître ECKHART sur le livre de la sagesse. *Archives d'histoire doctrinale et littéraire du moyen âge* 4, 233-404, 1929. ISIS

Théry, G. Edition critique des pièces relatives au procès d'ECKHART contenues dans le manuscrit 33 de la Bibliothèque de Soest. *Archives d'histoire doctrinale et littéraire du moyen âge* 1, 129-268, 1926-27. ISIS

XIVth Century (second half)

Boffito, Giuseppe. Il primo compasso proporzionale costruito da FABRIZIO MORDENTE e la *Operatio cilindri* di PAOLO DELL'ABBACO. 31 p., plate, illus. "Il facsimile" no. 6, Collezione diretta da G. BOFFITO e G. FUMAGALLI. Florence, Libreria internationale, succ. SEEBER, 1931. (18 lire). ISIS

An edition of the *Operatio cilindri* written in 1365 by PAOLO DELL'ABBACO, with a facsimile of the unique manuscript Palatine n. 798. PAOLO, a member of the noble family of DAGOMARI, was born in 1281, probably in Prato and died in Florence about 1373. He was a most noteworthy mathematician, astronomer and poet, much praised by contemporary and later writers. This cylinder was an extremely useful instrument, combining the functions of the astrolabe, calendar, and gnomon. According to BOFFITO the importance of its invention is comparable to the discovery of the proportional compass described by FABRIZIO MORDENTE in the second half of the sixteenth century. M. C. W.

Cameron, Kenneth Walter. A discovery in JOHN DE MANDEVILLES. *Speculum* 11, 351-59, 1936. ISIS

Ercole, Francesco. Da BARTOLO ALL'ALTUSIO. Saggi sulla storia del pensiero publicistico del Rinascimento Italiano. 429 p. Florence, VALLECCHI, 1932. ISIS

Reviewed by MARIO EINAUDI, *Speculum* 11, 405-09, 1936.

Gandillac, Maurice Patronnier de. De l'usage et de la valeur des arguments probables dans les questions du cardinal PIERRE D'AILLY sur le "Livre des Sentences." *Archives d'histoire doctrinale et littéraire du moyen âge* 8, 43-91, 1933. ISIS

Gandz, Solomon. The invention of the decimal fractions and the application of the exponential calculus by IMMANUEL BONFILS of Tarascon (c. 1350). *Isis* 25, 16-45, 1936. ISIS

Including a new Hebrew text with English translation and preface by G. SARTON. IMMANUEL BONFILS was a forerunner of CHUQUET and indirectly of STEVIN. This publication places him among the great mathematicians of the fourteenth century. G. S.

(Groote, Gerhard). GERARDI MAGNI Epistolae, quas ad fidem codicum recognovit annotavit edidit W. MULDER. xlvii + 359 p. (Tekst-uitgaven van Ons Geestelijk Erf, 3). Antwerp, sumptibus Societatis Editricis Neerlandiae, 1933. ISIS

Reviewed by HEINRICH SPROEMBERG, *DLZ* 57, 996-99, 1936.

Rich, Theodore F. GIOVANNI DA SANMINIATO and COLUCCIO SALUTATI. *Speculum* 11, 386-90, 1936. ISIS

Sarton, George. The views of IMMANUEL BONFILS of Tarascon (fl. c. 1340-70) on decimal fractions? *Query no.* 58. *Isis* 25, 132-33, 1936. ISIS

Stadtmüller, Georg. Eine griechische Übersetzung des italienischen Apokalypsenkommentars von FEDERIGO DA VENEZIA O. P. iv + 55 p. (Texte u. Untersuchgn. z. Gesch. d. altchristl. Literatur. 48). Leipzig, HINRICH, 1936. ISIS

Reviewed by HUGO DUENSING, *DLZ* 57, 1089-90, 1936. This commentary was originally ascribed to NICHOLAS OF LYRA. M. C. W.

XVth Century (whole and first half)

Combes, André. Un témoin du Socratisme chrétien au XV^e siècle : ROBERT CIBOULE (1403-58). *Archives d'histoire doctrinale et littéraire du moyen âge* 8, 93-259, 1933. ISIS

Dodgson, Campbell. Woodcuts of the XV century in the department of prints and drawings, British Museum. Volume 2, frontispiece, 59 pl. London, KEGAN PAUL, 1935. ISIS

Gothein, Percy. FRANCESCO BARBARO (1390-1454). Früh-Humanismus und Staatskunst in Venedig. 420 p. Verlag Die Runde, Berlin, 1932. ISIS

XVth Century (second half)

Balmer, Lucie. Tonsystem und Kirchentöne bei JOHANNES TINCTORIS. Berner Veröffentlichungen zur Musikforschung. H. 2, 282 p. Bern, HAUPT, 1935 (10 Swiss francs). ISIS

Capparoni, Pietro. Il " Tractatus de fascinatione " di DIEGO ALVAREZ CHANCA. *Atti e memorie dell'Accademia di storia dell'arte sanitaria*, anno 35, fasc. 1, 4 p. Roma 1936. ISIS

Festugière, A. J. Studia mirandulana. *Archives d'histoire doctrinale et littéraire du moyen âge* 7, 143-250, 1932. ISIS

Wilson, W. J. An alchemical manuscript by ARNALDUS DE BRUXELLA. *Osiris* II, pt. 8, 220-405, 2 pl., 1936. ISIS

This is a very important addition to the literature on mediaeval alchemy. Contents : Preface; 1. Description and history of the manuscript; 2. ARNALD OF BRUSSELS as printer and scribe; 3. Recipes on book-making, metal-working, glass, etc.; 4. Origin and development of the alchemical tradition; 5. Recipes on the color, weight, and malleability of metals; 6. The contest of the alchemists and goldsmiths; 7. The philosophers' stone and the elixir of life; 8. Purgation, filtration, distillation, sublimation, and calcination; 9. Cementation as an alchemical process; 10. Other terms, including projection and multiplication; 11. General estimate of fifteenth century alchemy; 12. Other features : allegorical, medical, magical; Appendix I. List of abbreviated references; Appendix II. Treatises and poetical selections in the manuscript; Appendix III. *Obra de la Alkimia de Hermes;* Appendix IV.

Extracts from the *Liber Phenicis;* Appendix V. *Aenigme*, in French verse; Index of names and technical terms; Index of titles and incipits.

Correction communicated by the author: On p. 371 I have put down no. 29 as "apparently unprinted and unrecorded." But SINGER (*Cat.* ii, p. 429) records this piece as no. 603 and gives two XVth cent. Mss. The incipit is: *Erat quidem rex...*, whereas my incipit is *Quidam rex...* Hence I failed to find it in her index of incipits. G. S.

Zinner, Ernst. JOHANNES MÜLLER von Königsberg (REGIOMONTANUS). *Philobiblon*, eine Zeitschrift für Bücherfreunde 9, 89-97, 1936. ISIS

With a list of the published works (121 items) of REGIOMONTANUS. M. C. W.

Leonardo da Vinci

Heydenreich, Ludwig Heinrich. Studi archeologici di LEONARDO DA VINCI a Civitavecchia. *Raccolta vinciana* 14, 39-53, 7 fig., 1930-34. ISIS

Raccolta Vinciana. Fascicolo XIV, 1930-34. xxviii + 350 p., 60 fig. Milano, Castello Sposzesco 1935 (Lire 40). ISIS

The previous volume of the *Raccolta* published in 1930 was reviewed in *Isis* 15, 174. In the meanwhile the creator of the collection ETTORE VERGA (Perugia 1867-1930) has passed away, but the collections which he organized, as well as the first thirteen volumes of the *Raccolta* and his *Bibliografia vinciana*, 1493-1930 (2 vols., 835 p., Bologna 1931), will remain a memorial and a blessing to his memory. I remember visiting him years ago in his office of the Castello Sforzesco, I remember with joy his eagerness and enthusiasm. The present volume contains obituary notices and portraits of him, and of two other Vincianists, LUCA BELTRAMI (Milano 1854-1933) and GIROLAMO CALVI (Milano 1874-1934). This is followed by five "Studi vinciani," none of which is of special interest to the historian of science, and a bibliography. No index. G. S.

XVIth Century (whole and first half)

A. — *Mathematics*

Struik, D. J. Mathematics in the Netherlands during the first hal of the XVIth century. *Isis* 25, 46-56, 1936. ISIS

With a "bibliography of mathematical publications relating to mathematics in the Netherlands which appeared before 1570."

B. — *Physical sciences and technology*

Birkenmajer, Aleksander. Comment COPERNIC a-t-il conçu et réalisé son œuvre? *Organon* 1, 111-34, 1936. ISIS

Feldhaus, F. M. Das Prinzip unserer Gruben-Sicherheitslampe vor 400 Jahren. *Preussag-Werks-Zeitung*, 11. Aug., 1 fig., 1935. ISIS

Zur Zeit des Kaisers MAXIMILIAN I. (um 1517) hatte man bei den höfischen Fackel-Tänzen Draht-Masken vor dem Gesicht, damit die Flammen und Funken der Fackeln keinen Schaden tun konnten. Erst 300 Jahre später wandte DAVY den Drahtschutz an seiner Gruben-Lampe an. Auf einem Holzschnitt von BURGKMAIR und in dem grossen Werk " Kaiser MAXIMILANS... Triumph " sieht man Tänzer mit Drahtmasken in den Jahren 1514 bis 1526.

C. — *Natural sciences*

Lidell, Hilding. Über OLAUS MAGNUS und seine Quellen. *Lychnos* 1, 316-18, 1936 (in Swedish, with German summary, p. 318). ISIS

" Der Verfasser weist auf, dass eine Stelle in OLAUS MAGNUS' *Historia de gentibus septentrionalibus* (XIX : 7) wo dieser—anscheinend eigene Erfahrungen benutzend—von den nordischen Adlern erzählt, tatsächlich nur eine leichte Bearbeitung einer Stelle in ALBERTUS MAGNUS' *De Animalibus* (XXIII : 15) ist."

Lynam, Edward. The map of the British Isles of 1546. 6 p. Jenkintown, GEORGE H. BEANS Library, 1934. ISIS

Reviewed by E. HEAWOOD in *Geographical Journal*, 86, 174-76, 1935. Attributed on strong evidence to GEORGE LILY. C. W. A.

Tricot-Royer, Dr. Les observations ethnographiques, médicales et hygiéniques de PIGAFETTA, chroniqueur de MAGELLAN. *Le scalpel*, no. 3, 7 p., 1936. ISIS

Wölfli, Heinrich (HENRICUS LUPULUS, 1470—c. 1533). HEINRICH WÖLFLIS Reise nach Jerusalem 1520-1521. Veröffentlichung der Schweizer Bibliophilen Gesellschaft, hrsg. von HANS BLOESCH. 132 p. Bern, 1929. ISIS

D. — *Medical sciences*

Birchler, Linus; Fritz Medicus und Hans Fischer. Beiträge zur Charakteristik von THEOPHRASTUS PARACELSUS. Vorträge gehalten

an der 116. Jahresversammlung der Schweizerischen Naturforschenden Gesellschaft zu Einsiedeln (17.-20. August 1935). 40 p. Basel, BENNO SCHWABE, 1936. ISIS

Gundolf, Friedrich. PARACELSE. Traduit de l'allemand par S. STELLING-MICHAUD (Les cahiers romands, 2e série, 4). 236 p. Lausanne, PAYOT, 1932. ISIS

Hult, O. T. PARACELSUS in older and recent research. *Lychnos* 1, 183-207, figs., 1936 (in Swedish, with English summary, p. 207). ISIS

" From older and recent sources the author gives a short account of PARACELSUS against the background of his time. From his home in Einsiedeln and Villach, where his father was a physician, we follow the young iconoclast and enthusiast with a passion for knowledge on his wanderings in foreign countries, where he meets with the vicissitudes of fortune, we imagine him in Ferrara with his newly acquired doctor's degree, we listen to him attacking the antiquated medicine of the old school from the chair in Basel, we see him in Vienna, where he scored perhaps his greatest triumphs as a medicus, in St. Gallen, Nürnberg, Strassburg and other halting-places on the long way to Salzburg, where death ended his restless life. PARACELSUS's strange way of living is also illustrated by extracts from the Danish physician and chemist PETER PAYNGH's perhaps too much neglected ' Rapsodia vitae THEOPHRASTI PARACELSI,' probably written some time in the beginning of the seventeenth century. Finally the author tries to give an appreciation of PARACELSUS as a man, physician and philosopher together with a short summary of his chemico-biological system of the diseases, coloured by his mystic-religious-magical philosophy. PARACELSUS's great importance as a pioneer of the new ideas in the medical science is emphasized."

Ivins, William M., jr. The woodcuts to VESALIUS. *Bulletin of the Metropolitan Museum of Art* 31, 139-42, 1 fig., 1936. ISIS

Medicus, Fritz. The scientific significance of PARACELSUS. *Bulletin of the institute of the history of medicine* 4, 353-66, 1936. ISIS

Waller, Erik. Eine unbekannte Ausgabe von VESALS Epitome. *Lychnos* 1, 251-60, 1936. ISIS

Zimmermann, E. L. Early collections of syphilologic works. ALOYSIUS LUISINUS and his influence on syphilology. *Bulletin of the institute of the history of medicine* 4, 582-99, 1 fig., 1936. ISIS

E. — *Alia*

(Erasmus). Journées Erasme, 14 et 15 juillet 1936. Administration communale d'Anderlecht (a folio sheet printed on both sides). ISIS

Program of festivities organized by the town of Anderlecht (a part of the greater Brussels) to celebrate the fourth centenary of ERASMUS' death in Basel (July 12, 1536). G. S.

(Erasmus). Quatercentenary of ERASMUS. An exhibition in Bodley. *Times literary supplement*, p. 384, May 2, 1936. ISIS

Lindeboom, G. A. Erasmiana medica. *Bijdragen tot de geschiedenis der geneeskunde* 16, 108-14, 1936. ISIS

Nuyens, B. W. Th. ERASMUS en de geneeskunde. *Bijdragen tot de geschiedenis der geneeskunde* 16, 101-07, 1 pl., 1936. ISIS

ERASMUS and medicine.

Pfeiffer, Rudolf. Humanitas Erasmiana. Studien der Bibliothek Warburg, hrsg. von FRITZ SAXL, 22. Berlin, TEUBNER, 1931. ISIS

Schulte, J. E. ERASMUS en de eugenetische gedachte. *Bijdragen tot de geschiedenis der geneeskunde* 16, 132, 1936. ISIS

Werthemann, A. Schädel und Gebeine des ERASMUS von Rotterdam, mit 13 Abbildungen und 21 Tafeln. 82 p. Basel, EMIL BIRKHÄUSER, 1930. ISIS

XVIth Century (second half)

A. — *Mathematics*

Stevin, Simon (Correction to *Isis* 21, 250). With regard to his interpretation of DIOPHANTOS see above section III (2). G. S. ISIS

B. — *Physical sciences and technology*

Andersson, Ingvar. King ERIK XIV of Sweden and astrology.

Lychnos 1, 103-29, 1936 (in Swedish, with English summary, pp. 129-30). ISIS

" It would be hard to overestimate the part astrology plays in the mental world of the 16th and 17th centuries; and in studying the art and literature of this period, its scientific approach and its notions of the casual connections behind great political events, we must consider astrological habits of thinking. Star interpretation has been of importance to biography too; WALLENSTEIN is the best known example. In the history of Scandinavia during the 16th century ERIK XIV of Sweden is a similar case, and in Swedish archives and libraries there is peculiarly notable material for knowledge about his astrological interests. This essay is intended to give an idea of the extent and kind of the material we have, and a few indications of its contents and the lines along which a detailed interpretation should be made."

Boffito, Giuseppe. FAUSTO VERANZIO, di Sebenico (Dalmazia) 1551-1617 a Venezia; novizio b. (1608-1609) a Zagarolo; vescovo di Czanad (Ungheria); filosofo, filologo e, sovratutto, tecnico. *Scrittori Barnabiti* 4, 149-58, facs., 1934. ISIS

Feldhaus, F. M. Eine Presse für Schmelztiegel von 1573. 85 p., 1 fig. *Keramische Rundschau*, Nr. 8, 1935. ISIS

LAZARUS ERCKER VON SCHRECKENFELS gibt in seinem Buch " Aula subterranea " (Frankf. a. M. 1573, Seite 84) an, wie man Tiegel schnell unter einer Schraubenpresse herstellen kann.

Hiller, Johannes Erich. BOÈCE DE BOODT (1550-1632), précurseur de la minéralogie moderne. *Annales Guébhard-Séverine* 11, fasc. 2, 74-81, 1935. ISIS

Noll-Husum, H. NOSTRADAMUS und die Astronomie. Ein Beitrag zur Methode der Astro-Chronologie. *Vierteljahrsschrift der astronomischen Gesellschaft* 71, 242-49, 1936. ISIS

Twyne, Thomas (1543-1613). Discourse on the earthquake of 1580. Edited by R. E. OCKENDEN. 40 p. Oxford, Pen-in-hand publishing Co., 1936. ISIS

THOMAS TWYNE physician, astrologer, friend of JOHN DEE, is best known because of his metrical translation of the *Aeneid*. He wrote and translated various other works. His " *Discourse* is the most important of several pamphlets published on the earthquake which occurred on Wednesday evening, April 6, 1580. This earthquake was felt throughout the plains of south-east England, Flanders, and north-east France, and was certainly one of the greatest ever known at London. Some contemporary writers say that the disturbed area extended as far as York and Cologne, but this

does not seem very probable; Paris and Brussels, however, were slightly shaken. The places most seriously affected were in east Kent, where, says TWYNE, the earthquake ' seemed to begin, and to rage most fiercely '; several churches near the coast were damaged, and parts of Dover and Saltwood castles are said to have collapsed. In London an apprentice was killed by the fall of a stone from the roof of Christ's Hospital Church; some stones were also shaken from St. Paul's Cathedral and the Temple Church, and chimneys in various parts of the City were thrown down. The shock was felt in other parts of south-east England as far distant as Saffron Walden, Norwich, and Oxford. Aftershocks were experienced in Kent and the English Channel, but apparently not elsewhere. Little or no damage was done in France and Belgium, except perhaps at Calais. It is noticeable, however, that the earthquake was more strongly felt at towns near the coast, such as Antwerp, Bruges, Calais, Boulogne, and Abbeville, than at those farther inland. The sea was greatly disturbed, although the weather was calm; even the Thames at London, according to TWYNE, experienced a ' strange unquietnesse and working.' It is therefore probable that the earthquake was of submarine origin, and that its epicentre was near the east coast of Kent. TWYNE's account of the earthquake at London is remarkably free from exaggeration, and contains several interesting details on this little-known subject. The original edition of his *Discourse*, however, is now very rare, and has not hitherto been reprinted. It is hoped that the present edition will render it somewhat more accessible." OCKENDEN has added to the text a bibliography of works on that earthquake, which might perhaps be considered together with the bibliography relative to the comet of 1577 (C. D. HELLMAN in *Isis* 22, 41-68). That is, astrologers or astrologically-minded persons, writing on the earthquake of 1580 may have referred also to the comet of 1577 and drawn conclusions from the succession of these two portentous events? G. S.

C. — *Natural sciences*

Rytz, Walther. Das Herbarium FELIX PLATTERS. Ein Beitrag zur Geschichte der Botanik des XVI. Jahrhunderts. *Verhandlungen der Naturforschenden Gesellschaft in Basel*, 44, 1. Teil, 222 p., 16 fig., 1933. ISIS

Very elaborate publication. G. S.

Viviani, Ugo. Tre Medici Aretini (A. CESALPINO, F. REDI e F. FOLLI). 249 p., ills. Arezzo, R. Accademia Petrarca Editrice, 1936. ISIS

This includes a biography and bibliography of CESALPINO covering some 60 pages. G. S.

D. — *Medical sciences*

Edgar, Irving I. Elizabethan conceptions of the physiology of the circulation. *Annals of medical history* 8, 359-70, 1936. ISIS

McDaniel, W. B. jr. The unfinished London reprint of SERVETUS' "Restoration of Christianity." *Annals of medical history* 8, 270, 1936. ISIS

Napjus, J. W. RAPHAËL CLINGBJL (1569-1608). *Bijdragen tot de geschiedenis der geneeskunde* 16, 85-88, 1936. ISIS

Nuijens, B. W. Th. Burgemeester Doctor MARTIN JANSZOON COSTER (d. 1592), genaamd MARTINUS AEDITUUS, eerste voorlezer der anatomie te Amsterdam. Een schets van zijn leven en van zijn bibliotheek. *Bijdragen tot de geschiedenis der geneeskunde* 16, 77-84, 1936. ISIS

Watson, E. M. Medical lore in SHAKESPEARE. *Annals of medical history* 8, 249-65, 1936. ISIS

E. — *Alia*

Castellio, Sebastian. Concerning heretics. Whether they are to be persecuted and how they are to be treated, a collection of the opinions of learned men both ancient and modern. An anonymous book ascribed to SEBASTIAN CASTELLIO. Now first done into English, together with excerpts from other works of SEBASTIAN CASTELLIO and DAVID JORIS on religious liberty. By ROLAND H. BAINTON. New York, Columbia University Press, 1935 ($ 4). ISIS

The *De haereticis* (Magdeburg 1554) was published as a protest against the execution of MICHAEL SERVETUS for heresy (Geneva, Oct. 23, 1553) in two simultaneous Latin editions as well as in French and German translations. SEB. CASTELLIO or CASTALION or more correctly SEBASTIEN CHÂTILLION was a Dauphinois, a minister of the Gospel, who died at Basle (1515-63). G. S.

Gadelius, Bror. The medical man and the witch during the Renaissance. *Lychnos* 1, 279-301, 1936 (in Swedish with English summary, pp. 300-01). ISIS

Apropos of G. ZILBOORG's recent book (1935) on JOHANNES WEYER, for which see *Isis* 25, 147-52. G. S.

Hála, Rudolf. CHRISTOPH PLANTIN, aus der Blütezeit des Buchdruckes in Antwerpen. 38 p. (In Philobiblon 9, 38 p., 1936). Wien, REICHNER, 1936. ISIS

Lindberg, Sten. Zur älteren Geschichte der Universität von Uppsala. *Lychnos* 1, 308-12, 1936 (in Swedish, with German summary, p. 312). ISIS

" CLAES ANNERSTEDT, einer der hervorragendsten Männer schwedischer Gelehrsamkeit, hat in seiner Geschichte der Universität von Uppsala die Zeit der Wiederherstellung dieser Universität durch König JOHANN III. in den Anfang des Jahres 1572 gesetzt. Durch einen Fund im schwedischen Reichsarchiv ist es aber nun möglich geworden, diese Grenze auf das Jahr 1571 festzusetzen. Aus einem Diarium 1568-71 sieht man, dass König JOHANN am 2. Juni 1571 den Professoren und Studenten des Kollegiums zu Uppsala eine Anweisung auf eine gewisse Geldsumme erteilt hat. Und am 5. Sept. desselben Jahres beordert er BENEDICTUS OLAI, den Arzt des abgesetzten Königs ERICH XIV. in das gleiche Kollegium."

Zilboorg, Gregory. The medical man and the witch during the Renaissance. x + 215 p. (*Publications of the Institute of the history of medicine*, the Johns Hopkins University, 3rd series, 2). Baltimore, Johns Hopkins Press, 1935. ISIS

Reviewed by GEORGE SARTON, *Isis* 25, 147-52, 2 facs., 1936.

XVIIth Century (whole and first half)

A. — *Mathematics*

Bricard, Raoul. Sur un théorème célèbre d'arithmétique. *L'Enseignement scientifique* 9, 240-42, 1936. ISIS

" Ce théorème fameux, énoncé dès 1625 par A. GIRARD, retrouvé par FERMAT, n'a été démontré qu'en 1749 par EULER."

Ockenden, R. E. Apropos of HENRY LYTE (note to SARTON's " First explanation of decimal fractions," *Isis* 23, 158, 1935). *Isis* 25, 135, 1936. ISIS

B. — *Physical sciences and technology*

Caspar, Max. Bibliographia Kepleriana. Ein Führer durch das gedruckte Schrifttum von JOHANNES KEPLER, mit 80 Faksimile. Im Auftrag der bayerischen Akademie der Wissenschaften, unter Mitarbeit von LUDWIG ROTHENFELDER. 158 p. München, BECK, 1936 (RM. 13.90). ISIS

Very elaborate bibliography of all the printed editions of KEPLER's books, letters, in the original form and also in translations. There is also a fac-

simile of KEPLER's own list of his publications down to 1622 written in his own hand. The list has been compiled with fastidious care and is followed with a magnificent series of 80 facsimiles. CASPAR's book should be included in every Keplerian collection, and also in every library on the history of astronomy. The author is a Keplerian scholar of long standing whose studies have often been discussed or mentioned in *Isis* (see, e.g., vol. 6, 163; 13, 118; 17, 503). This increases considerably the value of his bibliography. G. S.

Caspar, Max. JOHANNES KEPLERS wissenschaftliche und philosophische Stellung. 37 p. (*Schriften der Corona*, 13). München, OLDENBOURG, 1935. ISIS

McColley, Grant. The second edition of *The discovery of a world in the moone*. *Annals of science* 1, 330-34, 3 pl., 1936. ISIS

Seares, Frederick H. GALILEO. *Publications of the Astronomical society of the Pacific* 48, 8 p., 1936. ISIS

Zinner, Ernst. JOHANNES KEPLER, 1571-1630. Die Grossen Deutschen (Neue Deutsche Biographie), 532-45, ills. Berlin, Propyläen Verlag (no date, received July 1936). ISIS

C. — *Natural sciences*

Clouzot, E. Essai sur la cartographie du Léman. La carte de JACQUES GOULART (1605). Genava, vol. 11, 171-87, ill., Genève, 1933. ISIS

Powell, J. W. Damer. The explorations of JOHN GUY in Newfoundland. *Geographical journal* 86, 512-18, 1935. ISIS

Transcript of those portions of a manuscript entitled ' A Journall of the voiadge of discoverie made in a barke builte in Newfoundland called the Indeavour, begunne the 7 of October 1612 & ended the 25th of November following. By JOHN GUY of Bristow,' which were omitted in PURCHAS His Pilgrimes, 1905 edition, 19, 419. C. W. A.

D. *Medical sciences*

Napjus, J. W. AUGUSTINUS LOLLIUS ADAMA, hoogleeraar in de geneeskunde te Franeker. *Bijdragen tot de geschiedenis der geneeskunde* 16, 45-51, 1936. ISIS

Silvette, Herbert. The making of anatomies in seventeenth century England. *Annals of medical history* 8, 348-52, 1936. ISIS

Van der Wielen, P. De eerste nederlandsche pharmacopee, 1636-5 mai - 1936. *Bijdragen tot de geschiedenis der geneeskunde* 16, 57-63, 4 fig., 1936. ISIS

E. — *Alia*

Barreiro, Agustin J. La " Historia del Nuevo Mundo," del P. BERNABÉ COBO, S. J. (1582-1657). Asociación nacional de historiadores de la ciencia española, 43 p., Madrid, Gráfica universal, 1935. ISIS

Brown, Harcourt. The utilitarian motive in the age of DESCARTES. *Annals of science* 1, 182-92, 1936. ISIS

Chalmers, Gordon Keith. Sir THOMAS BROWNE, true scientist. *Osiris* 2, 28-79, 1936. ISIS

" To most of his readers Sir THOMAS BROWNE is an antiquary whose world is full of ' airy nuncios,' a phantastical person who loves ' to sit down with a description, periphrasis, or adumbration ' having learned from TERTULLIAN ' that odd resolution,' *Certum est quia impossibile est.* To these admirers of BROWNE, his quincunxes, and his wingy mysteries, it comes as a surprise that ROBERT BOYLE the great chemist called him a *naturalist* ' so faithful and candid ' that he should not be distrusted. But far from surprising to his other contemporaries, BOYLE's opinion that BROWNE was a good scientist agreed with their own estimate." Contents : 1. Scientific method; 2. Contributions to science; 3. Acceptance of new discoveries; 4. Science, theology and ethics; 5. Progress; 6. The aims of scientific research; 7. To what extent may we consider Sir THOMAS BROWNE a scientist?

Grape, Anders. COMENIUS, BENGT SKYTTE, and the Royal Society. *Lychnos* 1, 319-30, 1936 (in Swedish, with English summary, p. 330). ISIS

" The author reviews Dr. ROBERT FITZGIBBON YOUNG's book ' COMENIUS in England 1641-42 ' (London 1932), and dwells especially on the question whether this visit can be considered to have any influence on the foundation of the Invisible College and its later descendant the Royal Society. In this connection Miss DOROTHY STIMSON's argumentation (in *Isis* vol. 23, 373-388, 1935) against the notion of a causal connection between these facts is reported. The author points out some circumstances which seem to him to throw light upon these questions but leaves the point of controversy itself to further discussion. Of special interest is the fact that a Swedish name is involved in the debate, viz. Baron BENGT SKYTTE, a member of the Swedish Council, who had submitted a scientific project to King CHARLES II in the years

1660-1661, just about the same time as the Royal Society was founded. The author gives a general survey of SKYTTE's life, finding it stated beyond doubt that the project referred to was a plan for a kind of universal university similar to the one SKYTTE later on proposed to FREDERICK WILLIAM, the Great Elector of Brandenburg. The author hopes that Dr. YOUNG will eventually, according to his promise, make the investigations in English archives that are necessary for the further elucidation of SKYTTE's undertakings."

Källquist, Eskil. Die Lateinstadt des JACOB RUDBECKIUS. *Lychnos* 1, 151-78, 1936 (in Swedish, with German summary, pp. 178-79). ISIS

" Einer der bemerkenswertesten und interessantesten Pädagogen Schwedens im 17. Jahrhundert war JACOB RUDBECKIUS. Seine bedeutendsten Leistungen vollführte er als Schulrektor, zuerst in Örebro, 1615-1626, und dann in Stockholm, 1630-1640, daneben war er aber auch kürzere Zeit an dem neuerrichteten Gymnasium in Strängnäs und an der Adelsschule Collegium Illustre in Stockholm tätig. Gegen die Sitte der Zeit verblieb RUDBECKIUS sein ganzes Leben im Dienste der Schule, obwohl ihm im Jahre 1624 eine Professor der schwedischen Sprache an der Universität von Uppsala angeboten worden war. Über die Stellung von JACOB RUDBECKIUS zu den Unterrichtsmethoden der Zeit kann einiges aus einem hier veröffentlichten Aktenstück in Erfahrung gebracht werden, das, Meditationes de Schola genannt, zusammen mit anderen Eintragungen von seiner Hand in einer Handschrift des Reichsarchives von Stockholm enthalten ist. Diese Meditationes müssen gegen Ende der zwanziger Jahre oder in der ersten Hälfte der dreissiger Jahre des 17. Jahrhunderts geschrieben worden sein, mit einer gewissen Wahrscheinlichkeit kann 1629 oder 1630 als Abfassungszeit angesetzt werden. Der Vorschlag, den JACOB RUDBECKIUS in den Meditationes macht, geht darauf aus, eine Schule einzurichten, in der die lateinische Sprache durch praktischen Gebrauch leichter und besser werden könnte als durch Regeln, wie es in anderen Schulen der Fall war."

Schlueter, Robert E. Obstetrical art at St. Peter's in Rome. *Annals of medical history* 8, 227-31, 9 fig., 1936. ISIS

Apropos of the sculptor LORENZO BERNINI (1598-1680).

Wieselgren, Per. STIERNHIELMS wiedere tdecktes Familienarchiv (1598-1672). *Lychnos* 1, 261-70, 1936 (in Swedish, with German, summary p. 270). ISIS

Apropos of the archives of the Swedish poet and antiquary GEORG STIERNHIELM (1598-1672). G. S.

XVIIth Century (second half)

A. — *Mathematics*

Natanson, Wladyslaw. NEWTON. 53 p. Odbitka z " Przeglądu Współczesnego " Nr. 62, Czerwiec 1927 (in Polish). ISIS

(Newton, Isaac). Catalogue of the NEWTON papers sold by order of the Viscount LYMINGTON to whom they have descended from CATHERINE CONDUITT, Viscountess LYMINGTON, Great-niece of Sir ISAAC NEWTON, which will be sold by auction by Messrs. SOTHEBY and Co. 144 p., 16 pl. London, 34 and 35 New Bond St., 1936 (7/6). ISIS

Nordström, Johan. An unknown letter from NEWTON in Swedish possession. With an introduction. *Lychnos* 1, 225-29, 2 facs., 1936. ISIS

Letter dated Cambridge Nov. 22, 1693 to Professor OTTO MENCKE (1644-1707) of Leipzig, editor of the *Acta eruditorum*. G. S.

Oseen, C. W. NEWTON and our time. *Lychnos* 1, 217-23, 1936 (in Swedish, with English summary, p. 224). ISIS

" After a glance at the scholastic background to the scientific thinking of NEWTON and his contemporaries the author gives an account, based on M. P. BRUNET's work ' L'introduction des théories de NEWTON en France au XVIII[e] siècle,' of the critical attitude of the leading French physicists towards NEWTON's cosmological theory up to 1738. He then calls attention to some resemblances between the problems of our time and those of the age of NEWTON."

Scott, J. F. JOHN WALLIS (1616-1703), as a historian of mathematics. *Annals of science* 1, 335-57, 1936. ISIS

B. — *Physical sciences and technology*

Gunther, Robert T.; Andrade, E. N. da C. HOOKE and his editors. *Nature* 137, 702-03, 1936. ISIS

Apropos of the edition of HOOKE's diaries. G. S.

Kriloff, A. N. The fate of a celebrated theorem. *Archives of the history of science and technology* 8, 281-99, 1936 (in Russian with English summary). ISIS

" In lemma X of the third book of his ' Principia ' Sir Is. NEWTON has given a theorem of very great importance for the determination of parabolic orbits of comets. The proof he has given is purely geometrical, extremely simple and based on dynamical proprieties of the parabolic motion of a heavenly body."

C. — *Natural sciences*

Stearns, Raymond Phineas. The production of sugar in Barbados c. 1667. *Annals of science* 1, 173-81, 1936. ISIS

Strandberg, Olof. Contributions to the biography of URBAN HIÄRNE. *Lychnos* 1, 208-15, 1936 (in Swedish, with English summary, p. 216). ISIS

" The first item consists of a hitherto unknown letter from URBAN HIÄRNE, the well-known Swedish physician and naturalist (1641-1724), to his elder brother THOMAS. This letter, which is dated from Uppsala Oct. 29th 1661, is the earliest that we have in HIÄRNE's hand. The writer of the letter has just arrived at the university town in order to begin his studies of medicine under the professors OLAUS RUDBECK and PETRUS HOFFWENIUS. The second item imparts a catalogue, made by HIÄRNE in his old age, of his quite considerable collection of pictures. HIÄRNE's exceptionally difficult handwriting has made the decipherment of the manuscript an extremely complicated matter."

Viviani, Ugo. Tre Medici Aretini (A. CESALPINO, F. REDI e F. FOLLI). 249 p., ills. Arezzo, R. Accademia Petrarca Editrice, 1936. ISIS

Including in addition to CESALPINO's biography : Annotazioni all'*Elogio di F. Redi* dell'aretino GIROLAMO PERELLI; Due importanti questioni Rediane; Bibliografia su F. REDI; Nuove ricerche sulla vita e sulle opere di FRANCESCO FOLLI inventore della trasfusione del sangue; Bibliografia su F. FOLLI.

D. — *Medical science*

Esaguy, Augusto D'. Água de Inglaterra. *Bulletin of the institute of the history of medicine* 4, 404-08, 2 facs., 1936. ISIS

" Reference to Água de Inglaterra can be found in all Pharmacopoeiae published between the years 1681 and 1821, and there is no doubt that this famous mixture, invented by two Portuguese Jewish doctors, FERNANDO MENDES and JACOB DE CASTRO SARMENTO, was the most widely prescribed drug of its time."

Fosseyeux, Marcel. Un médecin français en Ethiopie au XVII[e] siècle.

Bulletin de la société française d'histoire de la médecine 31, 117-25, 1936. ISIS

Il s'agit de JACQUES-CHARLES PONCET mort en 1708. G. S.

Hoff, Ebbe C.; Hoff, Phebe M. The life and times of RICHARD LOWER, physiologist and physician (1631-1691). *Bulletin of the institute of the history of medicine* 4, 517-35, 1936. ISIS

Robinson, Victor. Medico-theologic consultations in the seventeenth century. *Medical life* 43, 153-61, 1936. ISIS

E. — *Alia*

Behaegel, Th. Le baron FRANÇOIS-MERCURE VAN HELMONT. *Le Folklore brabançon* 15, 402-41, 1936. ISIS

Irving, J. A. LEIBNIZ' theory of matter. *Philosophy of science* 3, 208-14, 1936. ISIS

Iwanicki, Joseph. LEIBNIZ et les démonstrations mathématiques de l'existence de Dieu. 320 p. Paris, VRIN, 1933. ISIS

Wilson, F. P. English letters and the Royal Society in the seventeenth century. *Mathematical Gazette* 19, 343-54, 1935. ISIS

XVIIIth Century (whole and first half)

B. — *Physical sciences and technology*

Bergstrand, Östen. Eine CELSIUSerinnerung. *Lychnos* 1, 180-82, 1936 (in Swedish, with German summary, p. 182). ISIS

" Der Verfasser hat in dem Observatorium von Uppsala ein Porträt des bekannten Bologneser Astronomen EUSTACHIO MANFREDI (1674-1739) wiedergefunden, das von LUCIA TORRELLI gemalt ist. Das Porträt war seinerzeit im Besitze des schwedischen Astronomen ANDERS CELSIUS, der in der Mitte der dreissiger Jahre des 18. Jh. Studienhalber in Bologna weilte und viel im Kreise MANFREDIS verkehrte."

Lomonosov, Mikhail Vasilyevich. Collected works. Vols. vi-vii. Leningrad, 1934. ISIS

Reviewed by T. L. D., *Isis* 25, 153-54, 1936.

C. — *Natural sciences*

Antonio, Neviani. Appunti sopra alcune recenti pubblicazioni che interessano l'Opera scientifica di LUIGI FERDINANDO MARSILI (1658-1730). *Rivista di storia delle scienze mediche e naturali* 27, 111-17, 1936. ISIS

Bertin, Léon. Les souvenirs de LINNÉ à Uppsal. *Revue scientifique* 74, 321-28, 1936. ISIS

Engel, H. LINNAEUS' voyage from Hamburg to Amsterdam. An explanation of some obscure points in his almanac. *Svenska Linné-Sällskapets Årsskrift* 19, 50-8, 1936. ISIS

" The author succeeds in elucidating some obscure points in the annotations in L's Almanac for 1735 (published in last year's volume) and the author has also made out a map showing the route that the ship followed."

Fries, Rob. E. Ett tvåhundraårsminne. *Svenska Linné-Sällskapets Årsskrift* 19, 1-6, 1936. ISIS

"A rich and interesting exhibition of Linnean papers and portraits had been arranged in connection with the VIth International botanical congress last autumn in Amsterdam. In Sweden, the commemorations were concentrated to LINNAEUS' birth-place, the Vicar's lodge at Råshult in Småland, where the old dwelling-house had been restored to its former state by the aid of public funds, and on the 2nd of June it was inaugurated at a large national festivity which was most graciously attended by their Royal Highnesses the Crown Prince and Crown Princess of Sweden. H.R.H. the Crown Prince made the inaugural speech and the Chairman of the Swedish Linnean Society Professor ROB. E. FRIES read this paper on the year 1735, the year that was so important in the life of LINNAEUS."

Gertz, Otto. LINNÉ och cecidologien, III. Några supplerande tillägg. *Svenska Linné-Sällskapets Årsskrift* 19, 121-28, 1936. ISIS

" Dr. O. GERTZ, lecturer at the Lund University, has enriched his essay on ' LINNAEUS and the Cecidology ' with some additions to his articles on this subject previously published in these volumes (vols. 12, 13)."

McKie, Douglas. BÉRAUT's (1703-1777) theory of calcination (1747). *Annals of science* 1, 269-93, 1936. ISIS

Springer, Leonard F. Hartekamp på LINNÉS tid och dess senare öden. *Svenska Linné-Sällskapets Årsskrift* 19, 59-66, 1936. ISIS

" The appearance of CLIFFORD's garden at Hartekamp about the year 1735

has not been previously known. At this famous garden, as is well known, LINNAEUS spent two years of his stay in Holland as superintendent and there he also wrote several of his works *inter alia* the magnificent ' Hortus cliffortianus.' Mr. LEONARD A. SPRINGER, wellknown horticultural architect, has lately published—in the Dutch periodical *Floralia*—a description of Hartekamp at the time of LINNAEUS based on a contemporary map which is now in his collections. This article is to be found in this volume in a Swedish translation, and besides, several illustrations showing what is left today of the buildings of that time."

Stearns, Raymond Phineas. The course of Capt. EDMOND HALLEY in the year 1700. *Annals of science* 1, 294-301, 1 pl., 1936. ISIS

D. — *Medical sciences*

Barry, Iris. Portrait of Lady MARY WORTLEY MONTAGU. 294 p., 8 pl. London, BENN, 1928. ISIS

Biography of Lady MARY MONTAGU (1689-1762) who introduced into England the pratice of inoculation for smallpox upon her return from Turkey (1718). See *Osiris* 1, 534, 1936. G. S.

Giordano, D. ALESSANDRO KNIPS MACOPPE. *Rivista di storia delle scienze mediche* 27, 127-52, 1936. ISIS

Hedlund, Emil. JOHAN STENSSON ROTHMAN. *Svenska Linné-Sällskapets Årsskrift* 19, 67-120, 1936. ISIS

" JOHAN STENSSON ROTHMAN, medical practitioner at Växjö in Småland, who was at the same time a teacher at the Grammar School in that town. He is known to have been LINNAEUS' first teacher in natural history and gave him, as has lately been proved by Mr. SPENCER SAVAGE, the learned secretary of the Linnean Society of London, his first knowledge of TOURNEFORT's botanical system, as well as of VAILLANT's ideas on the sexuality of plants as a ground of classification. The biography, is based on very rich material, *inter alia* ROTHMAN's own autobiography and documents in the ' Collegium medicum.' ROTHMAN was a man with wide-spread knowledge, well-read and in advance of the age, but in spite of this, he never succeeded in obtaining an important position though he was at several times proposed to a chair. The paper gives an interesting insight in the medical methods and conceptions of that time derived from ROTHMAN's extensive correspondence with the ' Collegium medicum ' and other official authorities. These letters deal especially with epidemics—dysentery, ergotismus—which raged in Småland at that time. ROTHMAN was born in 1684 and died in poor circumstances in 1763, after having been blind for many years."

Imann, Georges. NICOLAS ROZE et Monseigneur DE BELSUNCE. (La peste de Marseille en 1720). *Revue de Paris*, pp. 383-416. 15 juillet 1936. ISIS

McCoy, Raymond F. Hygienic recommandations of *The ladies library*. *Bulletin of the institute of the history of medicine* 4, 367-72, 1936. ISIS

Nilson, Gunnar. LINNAEUS som medicus vid amiralitetet i Stockholm. *Svenska Linné-Sällskapets Årsskrift* 19, 7-49, 1936. ISIS

" A detailed account of LINNAEUS' activity as physician to H. M. Navy during the years he spent at Stockholm after his return to Sweden till his appointment to the Chair of Medicine at Upsala. The author, GUNNAR NILSON, M.D., chief medical officer to the Admirality, gives an account of LINNAEUS' activity and of the conditions of the medical attendance in the Swedish fleet at that time, based on many original documents. He has found *inter alia* medical certificates made out by LINNAEUS and also a proposal made out by him to the furnishing of the Swedish men-of-war with medicine for the approaching war with Russia (1741-43). The author also treats LINNAEUS' theories in connection with the cure of syphilis and rheumatism, for the latter of which he thought he had found a cure in his ' own plant,' *Linnaea borealis*."

Sweet, Jessie M. SIR HANS SLOANE : life and mineral collection. Part 3 : mineral pharmaceutical collection. *Natural history magazine* 5, 145-64, 1935. ISIS

Two drawers in the British Museum of Natural history were shown in 1931 to contain SLOANE's medicine chest. The specimens here described at length are Terra sigillata, bezoar stones, Lapis Lyncis, Lapis judaicus, Lapis nephriticus, Lapis variolosus, rock-crystals and others. Many illustrations. C. W. A.

E. — *Alia*

Boissier, Raymond. LA METTRIE. Médecin, pamphlétaire et philosophe (1709-51). 184 p. Paris, Les Belles Lettres, 1931. ISIS

Huizinga, J. Naturbild und Geschichtsbild im 18. Jahrhundert. Übersetzt von WERNER KAEGI. *Corona* 5, 536-62, 1934-35. ISIS

XVIIIth Century (second half)

A. *Mathematics*

Boffito, Giuseppe. PAOLO FRISI, di Melegnano (Milano), 13 aprile 1728-1784, 22 novembre, pure in Milano ; p. 1744 ; scienziato e storico della scienza. *Scrittori Barnabiti*, vol. 2, 73-96, 1933. ISIS

Boffito, Giuseppe. PAOLO FRISI. Appendice. I documenti del R. Politecnico di Milano descritti dal prof. A. MASOTTI, le lettere della Biblioteca communale di Forlì, ecc. *Scrittori Barnabiti* 4, 381-97, frontispiece, Firenze, 1935. ISIS

Itard, Jean. Histoire de l'enseignement des mathématiques élémentaires : La géométrie de LEGENDRE. *L'enseignement scientifique* 9, 193-98, 1936. ISIS

Rupp, Otto. Über die Analogie zwischen Kreis und Hyperbel mit Berücksichtigung neuer Quellen. *Archiv f. Gesch. d. Math. d. Naturw. u. d. Techn.*, 13, 293-326, 20 fig., 1931. ISIS

B. — *Physical sciences and technology*

Boffito, Giuseppe. Primi ricordi d'aeronautica a Torino. *Atti della reale accad. delle scienze di Torino* 63, 144-51, 1928. ISIS

Boulton, Matthew (1728-1809). MATTHEW BOULTON as scientific industrialist. *Nature* 137, 645-46, 1936. ISIS

Dobbin, Leonard. A CULLEN chemical manuscript of 1753. *Annals of science* 1, 138-56, 1936. ISIS

Franklin, Benjamin, and his circle. A catalogue of an exhibition. ix + 155 p., fig. New York, Metropolitan Museum of Art, September 13, 1936. ISIS

Contents : Lenders to the exhibition; Preface by H. E. WINLOCK; BENJAMIN FRANKLIN : his interest in the arts, by R. T. H. HALSEY; The chief facts in FRANKLIN's life : a chronology with special reference to this exhibition, by AGNES D. PETERS; BENJAMIN FRANKLIN and his circle : notes on the objects in the exhibition (336 items) by R. T. H. HALSEY, JOSEPH DOWNS, and MARSHALL DAVIDSON.

Hall, Courtney Robert. A scientist in the early Republic, SAMUEL LATHAM MITCHELL, 1764-1831. v + 162 p., port. New York, Columbia University Press, 1934. ISIS

Reviewed by T. L. D., *Isis* 25, 154-55, 1936.

Hildebrand, Bengt. Recherches et documentation sur C. W. SCHEELE. *Lychnos* 1, 76-101 1936 (in Swedish, with French summary, p. 102). ISIS

" En 1936 nous célébrons le 150me anniversaire de la mort de CARL WILHELM SCHEELE. En souvenir de l'éminent chimiste suédois, à qui l'on doit quelques-unes des découvertes chimiques les plus remarquables, l'auteur nous livre, en utilisant aussi des sources inédites, une riche documentation sur la littérature et les recherches scheeléennes depuis l'époque de SCHEELE jusqu'à nos jours."

Hoff, Hebbel E. GALVANI and the pre-Galvanian electrophysiologists. *Annals of science* 1, 157-72, 1936. ISIS

Jakubovskij, B. V. Bridge projets of I. P. KULIBIN to cross the Neva. A single arch timber bridge of 298 m span. *Archives of the history of science and technology* 8, 191-52, 23 fig., 1936 (in Russian with English summary). ISIS

Lubimenko, Inna. La mission à l'étranger de l'académicien LEXELL (1780-1781). *Archives of the history of science and technology* 8, 327-58, (in Russian with French summary). ISIS

Šebunin, A. N. Les côtes de la mer noire en 1770-1780 et l'Académie des sciences (Les œuvres de A. I. GÜLDENSTEDT et l'expédition de W. F. ZOUEV). *Archives of the history of science and technology* 8, 75-109, 1936 (in Russian with French summary). ISIS

Seydl, Otto. Query no. 59 concerning the Brevicula descriptio Speculae astronomicae Pragae instructae Wittembergae, 1755, by JOSEPH STEPLING, S. J. *Isis* 25, 133, 1936. ISIS

Zabarinskij, P. P. The constructors and engineers of the first steam engines in Russia. *Archives of the history of science and technology* 8, 253-79, 1936 (in Russian with English summary). ISIS

Zabarinskij, P. P. The first " fire-engines " at the port of Cronstadt. A contribution to the history of the introduction of steam-engines in Russia. 208 p., ills. Moscow, Academy of Sciences of the USSR, 1936 (in Russian). ISIS

C. — *Natural sciences*

Miller, Genevieve. Unpublished autographs in the Welch medical library. 2. An autograph of RAMOND DE CARBONNIÈRES. *Bulletin of the institute of the history of medicine* 4, 505-10, 1936. ISIS

D. — *Medical sciences*

Beekman, Fenwick. JOHN HUNTER (1728-1793) in Portugal (two letters written by him, recently discovered). *Annals of medical history* 8, 288-96, 3 fig., 1936. ISIS

Delaunay, Paul. Une page inconnue de la vie de JACQUES BARBEU DU BOURG, docteur-régent de la faculté de Paris, (1709-1779), *Bull. de la société d'hist. de la méd.*, 32, 177-82, 1936. ISIS

Forbes, John. On percussion of the chest, being a translation of AUENBRUGGER's original treatise entitled: "Inventum novum ex percussione thoracis humani, ut signo abstrusos interni pectoris morbos detegendi." (Vienna, 1761). Introduction by HENRY E. SIGERIST. 31 p., portrait and facsimile of title page. Bull. Inst. Hist. Med. 4, 1936). Baltimore, Johns Hopkins 1936 (75 cents).

LEOPOLD AUENBRUGGER, the son of an innkeeper, was a good musician with a keen ear for sounds even from tapped barrels. He worked seven years on patients, checking his observations in autopsies, experimenting on cadavers, whose lungs he filled with water. Percussion initiated a development in anatomical physical diagnosis which later culminated in the use of X-rays. His treatise, originally published in 1761 in Latin and a second edition in 1763, was translated by JOHN FORBES (1787-1861) and published (1824) in conjunction with an abstract, prepared for the general use of busy practitioners, of his translation of LAENNEC's classical treatise. This translation with omissions is reprinted with Dr. SIGERIST's illuminating introduction, which sets forth the historical significance of this early medical tract.
C. A. K.

Force, John N. DANIEL SUTTON and the revival of variolation. University of California publications in public health, 1, 323-35, 1 fig., Berkeley, 1931. ISIS

Friedman, Reuben. JOHANN ERNST WICHMANN (1740-1802). The one hundred and fiftieth anniversary of his contribution to scabies. *Medical life* 43, 171-210, 9 fig., 1936. ISIS

Fulton, John F.; Cushing, Harvey. A bibliographical study of the GALVANI and the ALDINI writings on animal electricity. *Annals of science* 1, 239-68, 9 pl., 1936. ISIS

Giordano, Dr. Un italien chirurgien aux armées de NAPOLÉON: PAOLO ASSALINI. *Bull. de la société française d'histoire de la médecine* 31, 69-84, 1936. ISIS

(Goodwyn, Edmund). An early book on the respiration—1788. *Annals of medical history* 8, 376-77, 1 fig., 1936. ISIS

Apropos of EDMUND GOODWYN's monograph " The connexion of life with respiration," London 1788. M. C. W.

Gribel, Friedrich. Die Entwicklung der Wundbehandlung von der Mitte des 18. bis zur Mitte des 19. Jahrhunderts. 33 p. (*Abhandlungen zur Gesch. d. Med. u. d. Naturw.* 15). Berlin, EBERING, 1936. ISIS

Hazen, Allen T. SAMUEL JOHNSON and Dr. ROBERT JAMES. *Bulletin of the institute of the history of medicine* 4, 455-65, 1936. ISIS

Lane, John E. JEAN DEVÈZE (1753-1826?). Notes on the Yellow Fever epidemic at Philadelphia in 1793. *Annals of medical history* 8, 202-26, 1936. ISIS

Roddis, Louis H. WILLIAM WITHERING and the introduction of digitalis into medical practice. *Annals of medical history* 8, 185-201, 9 fig., 1936. ISIS

Sévery, M. et Mme. William de. Le comte et la comtesse GOLOWKIN et le médecin TISSOT. 200 p., 8 pl. Lausanne, PAYOT, 1928. ISIS

E. — *Alia*

Deichgräber, Karl. GOETHE und HIPPOKRATES. *Archiv für Geschichte der Medizin* 29, 27-56, 1936. ISIS

Hubert, René. L'esprit des sciences sociales dans l'*Encyclopédie*. *Revue d'histoire de la philosophie et d'histoire générale de la civilisation* 14, 107-33, 1936. ISIS

XIXth Century (whole and first half)

A. — *Mathematics*

Tribout, Henri. Un grand savant. Le général JEAN VICTOR PONCELET, 1788-1867. Préface de MAURICE D'OCAGNE. 225 p. Paris, SAFFROY, 1936 (12 fr.). ISIS

I already knew of this book when reading the proofs of my " Study of the history of mathematics " but I did not dare quote it because I had been thus far unable to obtain a copy of it. The book will be useful, as the author has been able to consult unpublished MSS., yet it is not distinguished and is rather disappointing. The bulk of PONCELET's MSS. had been faithfully kept by a little nephew, Maître FOURNIER-PONCELET in Saint-Mihiel, but they disappeared during the war (p. 17). The biography is followed by a bibliography of P.'s published and unpublished writings. G. S.

B. — *Physical sciences and technology*

Browne, C. A. Some relations of the New Harmony movement to the history of science in America. *Scientific monthly*, 42, 483-97, 1936. ISIS

Feldhaus, F. M. Ein Kriegsballon von 1812? Archiv des historischen Vereins von Unterfranken 70, 167, 1935. ISIS

FRANZ LEPPICH aus Würzburg baute 1812 während des Krieges von NAPOLEON in Russland einen militärischen Ballon, um die Stellungen des Feindes beobachten zu können und um Bomben abzuwerfen.

Hartmann, Ludwig. Ein unbekannter Brief ANDRÉ-MARIE AMPÈRE's an MICHAEL FARADAY. AMPÈRE's Originalapparate. *Archeion* 18, 18-22, 1936. ISIS

Hartmann, Ludwig. Unveröffentlichte Briefe und Dokumente des Physikers HANS CHRISTIAN OERSTED. *Archiv f. Gesch. d. Math., d. Naturw. u. d. Techn.*, 13, 326-50, 1931. ISIS

Hepburn, Joseph Samuel. Atomic weights—an historical sketch. *Medical life* 43, 163-68, 1936. ISIS

Janet, Paul. ANDRE-MARIE AMPÈRE (1775-1836). *Revue scientifique* 74, 112-19, 1936. ISIS

Kamenskij, V. A. First experiments in hot blast in Russia. *Archives of the history of science and technology* 8, 359-93, 1936 (in Russian with English summary). ISIS

Kuwaki, Ayao. The revolution in physics by FARADAY and MAXWELL. *Journal of the Japanese society for mathematics and physics*, vol. 5, 6 p., Tokyo, 1931 (in Japanese). ISIS

Lehnert, Georg. JUSTUS LIEBIG und die Giessener medizinische Fakultät. *Archiv f. Gesch. d. Math., d. Naturw. u. d. Techn.* 13, 351, 1931. ISIS

Liebig, Justus von. Experimentalchemie, 1848. Ernst-Ludwigs-Hochschulgesellschaft. Darmstadt (50 MK). ISIS

Note-book concerning LIEBIG's course on that subject in Giessen taken by KEKULÉ and reproduced facsimile in extenso. The original exists in the KEKULÉ-Zimmer of the Technische Hochschule, Darmstadt. G. S.

Ocagne, Maurice d'. AMPÈRE. Anniversaires, revue bi-mensuelle. N° 3, 1936. ISIS

Pelseneer, Jean. Six lettres inconnues de BERZELIUS à QUETELET. *Lychnos* 1, 313-15, 1936. ISIS

C. — *Natural sciences*

Crouse, Nellis M. The search for the Northwest passage. 534 p. New York, Columbia University Press, 1934. ISIS

Reviewed by R. B., *Geographical journal* 86, 173-74, 1935. Mainly devoted to the period from SCORESBY in 1817 to MCCLURE in 1853. C. W. A.

Geiser, S. W. A century of scientific exploration in Texas. Part 1 : 1820-1880. *Field and laboratory* 4, 41-55, 1936. ISIS

Including an annotated list of naturalists who explored Texas during that period. This has been done with great care,—obviously a labor of love. G. S.

Geiser, S. W. CHARLES WRIGHT's 1849 botanical collecting trip from San Antonio to El Paso ; with type-localities for new species. *Field and Laboratory* 4, 23-32, 1935. ISIS

Mawson, Sir Douglas. Some historical features of the discovery of Enderby Land and Kemp Land. *Geographical journal* 86, 526-30, 1935. ISIS

Reproduction of a portion of a chart of 1833, with manuscript additions recording the voyages of BISCOE and KEMP, preserved in the Hydrographic Department, Admiralty, London. C. W. A.

Wheatstone, Sir Charles (1802-74). Contribution à la physiologie de la vision (1838 et 1852). Traduit de l'anglais, complété par

des conseils pratiques et des planches d'exercices pour faciliter la vue à l'œil nu du relief des clichés stéréoscopiques par PIERRE TH. DUFOUR. 88 p., quarto, 4 pl. Lausanne, Imprimerie la Concorde, 1919. ISIS

D. — *Medical sciences*

Faucci, Ugo. In memoria di AGOSTINO BASSI (1773-1856) (Nel 1° centenario del " ... Mal del segno ") (1835-1935). La scoperta della natura parassitaria del " calcino." *Rivista di storia delle scienze mediche* 27, 59-102, 153-206, 1936. ISIS

Rosen, George. JOHN ELLIOTSON (1791-1868), physician and hypnotist. *Bulletin of the institute of the history of medicine* 4, 600-03, 1936. ISIS

Ruska, Julius. Nachlese zum Briefwechsel GOETHE-NEES VON ESENBECK. *Archiv f. Gesch. d. Med.*, 28, 365-80, 1936. ISIS

Schlueter, Robert E. A short biographical sketch of Dr. WILLIAM BEAUMONT (1785-1853). An address delivered before the medical staff and resident Sisters at St. Anthony's Hospital, St. Louis, Missouri, Monday, December 9, 1935. Reprinted from an unnamed journal. ISIS

Studnička, F. K. JOHANNES EVANGELISTA PURKINJES (1787-1869) histologische Arbeiten. *Anat. Anz.* 82, 1-80, 1936. ISIS

E. — *Alia*

Dehérain, Henri. Le consul orientaliste JOSEPH ROUSSEAU (1780-1831). Article II. *Journal des savants*, 26-35, 1936 (to be continued).

XIXth Century (second half)

A. — *Mathematics*

Bell, E. T. A detail in KRONECKER's program. *Philosophy of science* 3, 197-207, 1936. ISIS

Borel, Emile. Documents sur la psychologie de l'invention dans le domaine de la science. *Organon* 1, 33-42, 1936. ISIS

Pearson, Karl (1857-1936). Old Tripos days at Cambridge, as seen from another viewpoint. *Mathematical gazette* 20, 27-36, 1936. ISIS

Sketches of STOKES, CLERK MAXWELL, CAYLEY, TODHUNTER and other Cambridge mathematicians. C. W. A.

(Tannery, Paul). Une lettre inédite de PAUL TANNERY à FRÉDÉRIC HULTSCH. *Isis* 25, 57-9, 1936. ISIS

B. — *Physical sciences and technology*

Bialobrzeski, Czeslaw. MARJA SKLODOWSKA-CURIE. *Organon* 1, 295-304, 1936. ISIS

Bloch, M. M. Die Literatur zum Jubiläum D. I. MENDELEEVS. *Archives of the history of science and technology* 8, 395-403, 1936 (in Russian). ISIS

Campbell, W. W. SIMON NEWCOMB ; a tribute to his personality and accomplishments. *Science* 84, 165-69, 1936. ISIS

Donald, M. B. History of the Chile nitrate industry. II. *Annals of science* 1, 193-216, 6 pl., 1936. ISIS

Getman, Frederick H. FRANÇOIS-MARIE RAOULT, master cryoscopist. *Journal of chemical education* 13, 153-55, 2 fig., 1936. ISIS

Gregory, Sir Richard. Science in a changing world : recollections and reflections. *Nature* 137, 981-88, 3 fig., 1936. ISIS

Harig, G. RÖNTGEN " Jubiläum " im " Dritten Reich." *Archives of the history of science and technology* 8, 301-09, 1936 (in Russian with German summary). ISIS

Holmes, Harry N. Aluminium bells. *Nature* 137, 745, 1936. ISIS

Apropos of the half centenary of the discovery by CHARLES MARTIN HALL of the modern process of preparing aluminium (1886). G. S.

Langdon, William Chauncy. The early corporate development of the telephone. 31 p., 5 facs. *Bell Telephone quarterly*, 1923 ; revised 1935. ISIS

Natanson, Wladyslaw. Dziecięce lata MAXWELLA. 13 p. Odbitka z "Przeglądu Wspólczesnego" Nr. 126, Październik, 1932. ISIS

On JAMES CLERK MAXWELL (in Polish). G. S.

Newcomb, Simon (1835-1909). The unveiling of a monument erected to his memory by the Canadian government. *Scripta mathematica* 4, 51-6, 1 fig., 3 pl., 1936. ISIS

Radovskij, M. I. WERNER SIEMENS und die Entdeckung des Prinzips der Selbsterregung. *Archives of the history of science and technology* 8, 311-26, 1936 (In Russian with German summary). ISIS

Stark, J. PHILIPP LENARD als deutscher Naturforscher. *Nationalsozialistische Monatshefte* 71, 106-12, 1936. ISIS

Those who wish to know to what incredible extent scientific thought is being debased in Germany to-day, need only read this essay equally discreditable to STARK and LENARD. It is a monument of aberration. No enemy of STARK and LENARD could have done worse to discredit their memory. May be they will live to regret it, but *scripta manent.*

G. S.

Woodbury, Robert S. Documents concerning HENRY AUGUSTUS ROWLAND (1848-1901). *Query* no. 60. *Isis* 25, 134, 1936. ISIS

C. — *Natural sciences*

Doorly, Eleanor. The insect man. A tale of how the Yew tree children went to France to hear the story of JEAN HENRI FABRE in the places where he lived and to see the homes of some of the insects whose lifestory he has written. Introduction by WALTER DE LA MARE, and woodcuts by ROBERT GIBBINGS. xv + 170 p. Cambridge, HEFFER, 1936 (3/6). ISIS

"Here is a book about a man who spent his whole life with insects, watching them, discovering their most carefully kept secrets, making them answer his puzzled questions. His children joined with delight in his hunts, and all outdoor children since had only to come across one of his fascinating insect tales to want to hear more. Biology and biography for children are both becoming popular, and 'The insect man' is a good introduction to both. A charming little book which would make a perfect gift for an intelligent child. G. S.

Fisher, R. A. Has MENDEL's work been rediscovered? *Annals of science* 1, 115-37, 1936. ISIS

"The peculiar incident in the history of biological thought, which it has been the purpose of this study to elucidate, is not without at least one moral—namely, that there is no substitute for a careful, or even meticulous, examination of all original papers purporting to establish new facts. MENDEL's contemporaries may be blamed for failing to recognize his discovery, perhaps through resting too great a confidence on comprehensive compilations. It is equally clear, however, that since 1900, in spite of the immense publicity it has received, his work has not often been examined with sufficient care to prevent its many extraordinary features being overlooked, and the opinions of its author being misrepresented. Each generation, perhaps, found in MENDEL's paper only what it expected to find; in the first period a repetition of the hybridization results commonly reported, in the second a discovery in inheritance supposedly difficult to reconcile with continuous evolution. Each generation, therefore, ignored what did not confirm its own expectations. Only a succession of publications, the progressive building up of a *corpus* of scientific work, and the continuous iteration of all new opinions seem sufficient to bring a new discovery into general recognition."

D. — *Medical sciences*

Bergson, Henri. The philosophy of CLAUDE BERNARD. *Bulletin of Institute of the history of medicine* 4, 15-21, 1 port., 1936. ISIS

Billroth, Theodor (1829-94). BILLROTH und BRAHMS im Briefwechsel. Mit Einleitung. Anmerkungen und 4 Bildtafeln. viii + 528 p. Berlin, URBAN u. SCHWARZENBERG, 1935. ISIS

Chesney, Alan M. Two documents relating to medical education at the Johns Hopkins University. A report by DANIEL C. GILMAN, first president of the Johns Hopkins University and a letter by HENRY W. ACLAND, F. R. S. Regius professor of medicine in the University of Oxford. With an introductory note by ALAN M. CHESNEY. *Bulletin of the institute of the history of medicine* 4, 477-504, 1 fig., 1936. ISIS

Codellas, Pan S. WILLIAM ALEXANDER GREENHILL, M. D. (1814-94). *Annals of medical history* 8, 306-12, 1 fig., 1936. ISIS

Fischer, Ernst. An historical note on HELMHOLTZ's theory of hearing. *Annals of medical history* 8, 357-58, 1936. ISIS

Gage, Simon Henry. THEOBALD SMITH; investigator and man. *Science* 84, 117-22, 1936. ISIS

Howell, William Boyman. F. J. SHEPHERD, surgeon. His life and times. x + 252 p., 13 ill. London, DENT, 1935 (12/6). ISIS

Roesler, Hugo. NIELS RYBERG FINSEN's (1860-1904) disease and his self-instituted treatment. *Annals of medical history* 8, 353-56, 1936. ISIS

Schleich, Carl Ludwig (1859-1922). Those were good days. Translated by BERNARD MIALL. 280 p., 9 pl. New York, NORTON, 1936. ISIS

Autobiography of the inventor of local anaesthesia, a many sided man, gifted with an artistic temperament and considerable versatility. G. S.

Schleich, Carl Ludwig (1859-1922). Besonnte Vergangenheit. Lebenserrinerungen. Berlin, ROWOHLT, 1925. ISIS

E. — *Alia*

Keyser, Cassius Jackson. VILFREDO FEDERICO DAMASO PARETO, mathematician, economist, sociologist. *Scripta mathematica* 4, 5-23, 1936. ISIS

Raeder, Hans. A. B. DRACHMANN (27. Februar 1860-22. August 1935). (Tale holdt i Videnskabernes Selskab den 13. December 1935). 19 p., portrait. ISIS

XXth Century

A. — *Mathematics*

Frick, Bertha Margaret. Birthday celebration for Dr. DAVID EUGENE SMITH. *Isis* 25, 140, 1936. ISIS

Sergescu, Petre. Aperçu sur les mathématiques en Roumanie au XX^{e} siècle. Comptes-rendus du deuxième congrès des mathématiciens des pays slaves, Praha 1934, 257-62, Prague, 1935.

B. — *Physical sciences and technology*

Picard, Emile. L'évolution des idées sur la lumière et l'œuvre d'ALBERT MICHELSON. *Revue scientifique* 74, 33-48, 1936. ISIS

Polack, L. Die optisch-mechanische Analogie bei SCHRÖDINGER. *Archives of the history of science and technology* 8, 29-73, 1936 (in Russian with German summary). ISIS

Rosenfeld, L. La première phase de l'évolution de la théorie des quanta. *Osiris* II, pt. 6, 149-96, 4 port., 1936. ISIS

Weeks, Mary Elvira. M. and Mme. JOLIOT-CURIE, Nobel laureates, chemistry 1935. 12 p., 2 port. Hommage from women chemists of the United States assembled at the Kansas City meeting of the American Chemical Society, April 14, 1936. ISIS

C. — *Natural sciences*

Cooper, R. E.; Curle, A. O.; Fair, W. S. GEORGE FORREST explorer and botanist. 90 p. Edinburgh, Scottish Rock Garden Club, 1935. ISIS

Reviewed by J. S. L. G., *Geographical Journal*, 86, 290-91, 1935. Horticultural expeditions in north-west Yunnan from 1904 to his death in Yunnan in 1932. C. W. A.

Goodspeed, T. H. WILLIAM ALBERT SETCHELL (1864-). A biographical sketch. With a bibliography of Professor SETCHELL's works. 29 p., port. University of California Press, 1936. ISIS

Keith-Lucas (1879-1916). (Essays on him by various authors, edited ALYS KEITH-LUCAS). 132 p. Cambridge, HEFFER, 1934. ISIS

Lapicque, L. Un grand savant russe : IVAN PETROVITCH PAVLOV. *Les cahiers rationalistes*, 102-06, mars 1936. ISIS

D. — *Medical sciences*

Heiser, Victor. An American Doctor's Odyssey. Adventures in forty-five countries. viii + 544 p., port. New York, NORTON, 1936 ($ 3.50). ISIS

Magnificent account of work done in the Orient for the sake of public health by the author and his many associates of the Rockefeller Foundation. At a time when we are witnessing so many destructive activities and when great nations are preparing themselves for wholesale murder it is thrilling to read these stories of philanthropic efforts made with a disinterestedness and on a scale never witnessed before. G. S.

Laignel-Lavastine, M. L'œuvre historique de PIERRE MENETRIER. *Archeion* 18, 23-8, 1936. ISIS

E. — *Alia*

Albright, W. F. JAMES HENRY BREASTED, humanist. *American scholar* 5, 287-99, 1936. ISIS

Klibansky, Raymond; **Solmitz, Walter.** Bibliography of ERNST CASSIRER's writings. *Philosophy and history*, essays presented to ERNST CASSIRER, 339-46. Oxford, University Press, 1936. ISIS

Kuwaki, Ayao. La philosophie scientifique de E. MEYERSON. La culture franco-japonaise, nouvelle série nº 5, 9 p., Tokyo 1933 (in Japanese). ISIS

Meyerhof, Max. GOTTHELF BERGSTRÄSSER (1886-1933). *Isis* 25, 60-2, 1936. ISIS

With a portrait.

Pirenne, Henri (Verviers 22 Décembre 1862-Ukkel 24 October 1935). Obituary by J. HUIZINGA, *Handelingen en levensberichten van de maatschappij der nederlandsche letterkunde te Leiden*, 179-84, 1934-1935. ISIS

Sergescu, Petre. Obecny stan nauki w Rumůnji (L'organisation actuelle de la science en Roumanie). *Nauki polskiel* 19, 200-24, 1934. ISIS

PART II

HISTORICAL CLASSIFICATION

I. — ANTIQUITY

1. — **ANTIQUITY** (*generalities*)

Arendt, W. W. Zur Technik der Herstellung von Klingen im Altertum. *Archives of the history of science and technology* 8, 161-89, 14 fig., 1936 (in Russian with German summary). ISIS

Farrington, Benjamin. Science in antiquity. 257 p. (The Home university library of modern knowledge). London, THORNTON BUTTERWORTH, 1936. ISIS

A very brief, but clear and up-to-date account of the principal scientific ideas in antiquity. Contents: Egypt and Mesopotamia; 2. Early Greek Science. Part I. The Ionian schools; 3. Early Greek science. Part II. The Italian schools; 4. The atomic theory; 5. Greek medicine. The spread of the scientific spirit; 6. SOCRATES and PLATO. The attack on Ionian science; 7. ARISTOTLE. The restoration of the Ionian tradition; 8. The Alexandrian age; 9. The Graeco-Roman world; 10. Summary and conclusion. The decline of ancient science. Schedule of dates. Bibliography. M. C. W.

Forbes, R. J. Bitumen and petroleum in antiquity. 109 p., 6 tables, 2 maps, 54 fig. Leiden, BRILL, 1936. ISIS

Contents: Introduction; 1. Nomenclature and classification; 2. Where bitumens were found; 3. Collecting and refining bitumen; 4. Applications of bitumen; 5. Some minor applications of bitumen; 6. Bitumen in magic, medicine, agriculture and mummification; 7. Petroleum and Greek fire in warfare; Bibliography; Index.

"The extensive use of different members of the petroleum family is one of the most characteristic expressions of our modern civilization. Since the rise of the petroleum industry, after the development of drilling methods from 1860 onwards, the use of bitumen has been revived. During many centuries, throughout the Middle Ages and the Renaissance, the knowledge of the properties of this material, so extensively used in Antiquity, had slumbered or degenerated and bitumen was only remembered for its supposed magical or medicinal properties." ... "Everyone familiar with the results of modern archeology will have found many references to the use of bitumen in Antiquity. It is certainly a common building material in the eastern half of the Fertile Crescent, and it is often mentioned in connection with mummification or lacquers in Egypt. At the same time its hey-day seems to have been over with the coming of Hellenism. Amongst both the Romans and Greeks bitumens were rarely used although tars and pitches were more commonly so. There is a natural explanation for these facts."

Hertz, Amelia. Le rôle de la religion dans les civilisations prégrecques. *Scientia* 296-307, 1935. ISIS

Hiller, Johannes-Erich. Die Minerale der Antike. Ein Beitrag zur Geschichte der Mineralogie im klassischen Altertume. *Archiv f. Gesch. d. Math. d., Naturw. u. d. Techn.* 13, 358-402, 1931. ISIS

Mondolfo, Rodolfo. Su una presunta affermazione antica della sfericità terrestre e degli antipodi. *Archeion* 18, 7-17, 1936. ISIS

Neugebauer, Otto. Zur geometrischen Algebra (Studien zur Geschichte

der antiken Algebra III). *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abtg. B : Studien, 3, 245-59, 8 fig., 1936. ISIS

Contents : 1. Vorbemerkungen; 2. Die babylonische Algebra; 3. Die geometrische Algebra der Griechen; 4. Der Zahl- und Funktionsbereich der babylonischen Mathematik; 5. Elementargeometrie; 6. Schlussbemerkungen.

Tozer, H. F. A history of ancient geography. Second edition, with additional notes by M. CARY. xxii + 388 p. Cambridge, University Press, 1935. ISIS

Reviewed by G. R. CRONE, *Geographical Journal* 86, 478, 1935. The original text has been preserved, the editor having simply added thirty pages of notes at the end. C. W. A.

2. — EGYPT

Carré, Jean-Marie. Voyageurs et écrivains français en Egypte du début à la fin de la domination turque (1517-1840). De la fin de la domination turque à l'inauguration du canal de Suez (1840-1869). xxi + 400 p. (Publications de l'Institut français d'archéologie orientale, recherches d'archéologie, de philologie et d'histoire, 4). Le Caire, Institut français d'archéologie orientale, 1932. ISIS

Friedrich, Johannes. Himmelszeichen in ägyptischen und hethitischen Kriegsberichten. *OLZ* 39, 135-39, 1936. ISIS

Gardiner, Alan H. A lawsuit arising from the purchase of two slaves. *Journal of Egyptian archaeology* 21, 140-46, pl. XIII-XVI, 1935. ISIS

Gardiner, Alan H. The Egyptian origin of some English personal names. *Journal of the American oriental society* 56, 189-97, 1936. ISIS

Lutz, Henry Frederick. Speech consciousness among Egyptians and Babylonians. *Osiris* 2, part 2, 1-27, 1936. ISIS

Pogo, Alexander. Der Kalender auf dem Sargdeckel des IDY in Tübingen. *Studien der Bibliothek Warburg*, 19, 22-6, 1 pl., 1936. ISIS

Contents : a. Die Sargdeckel aus Assiut; b. Die Kalender mit 36 bzw.

mit 24 Spalten; c. Die roten Spaltenüberschriften und die Datierung der Kalender; d. Der Tübinger Kalender; e. Diagonale Kalender, Wasseruhren, Deckenbilder.

Schott, Siegfried. Die altägyptischen Dekane. *Studien der Bibliothek Warburg*, H. 19, 1-21, 1936. ISIS

Šolpo, N. A. Hoisting of weights in the building technics of ancient Egypt. *Archives of the history of science and technology* 8, 137-60, 1936 (in Russian with English summary). ISIS

Weights and balances in ancient Egypt. *Nature* 137, 890-92, 4 fig., 1936. ISIS

3. — BABYLONIA AND ASSYRIA

Bobrinskoy, G. V. A line of Brâhmî (?) script in a Babylonian contract tablet. *Journal of the American oriental society* 56, 86-88, 1 pl., 1936. ISIS

Feldhaus, F. M. Die älteste bekannte Darstellung eines Töpfers. Mit 1 Abbildung. *Keramische Rundschau*, Berlin, Nr. 34, 402, 1935. ISIS

Auf einem Siegelzylinder ist um 2200 vor Chr. dargestellt, wie Etana auf einem Adler zum Himmel emporsteight. Er sieht auf die Erde hinab, auf den Hirten mit der Herde, auf den Bäcker und den Töpfer. Dies ist auf dem Siegelzylinder dargestellt.

Forbes, R. J. Note on a lump of asphalt from Ur. *Journal of the institution of petroleum technologists* 22, 180-84, 2 fig., 1936. ISIS

Gadd, C. J.; Thompson, R. Campbell. A middle-Babylonian chemical text. *Iraq* 3, 87-96, 1 pl., 1936. ISIS

" The strange document here published is written with evident care on a perfectly preserved tablet of baked clay measuring $3\frac{1}{4} \times 2\frac{1}{16}$ in., now numbered 120960. It was acquired from a vendor who seemed to have trustworthy information that it was found at or near Tall 'Umar, the site of Seleucia on the Tigris, before the beginning of the American excavations there, which is an unexpected provenance in view of the dating by the reign of GULKISHAR, who was a king generally supposed to have ruled only over the extreme south of Babylonia, certainly not later than the seventeenth century B.C. This dating is itself not the least interesting feature of the document, for it gives us another text to add to the very few tablets hitherto published of the First Dynasty of the Sea-Land. But what is still more

extraordinary about the tablet is that it is unique in the history of chemistry, containing, as it does, the earliest record known of the actual formulae for the making of glazes. Up to the present the earliest extant texts of this kind (also in cuneiform) are from the Royal Library at Nineveh, no older than the seventh century B.C. There is a further difference between the composition of this early text and that of its later counterparts of the seventh century. The latter are written straightforwardly in comparatively easy language : but in the present text the writer, guarding his secrets with true professional jealously, has purposely disguised his meaning by artifices of writing which amount to a form of cryptography. He is far more difficult to understand than his later *confrères* in medicine, whose methods of concealing their knowledge from the layman are, by comparison, simple."

Loria, Gino. Sur l'arithmétique babylonienne. *Archeion* 18, 63-5, 1936. ISIS

Apropos of NEUGEBAUER's *Mathematische Keilschrift-Texte*, Berlin 1935.

Loud, Gordon. An architectural formula for Assyrian planning based on the results of excavations at Khorsabad. *Revue d'assyriologie et d'archéologie orientale* 33, 153-60, 2 fig., 1936. ISIS

Lutz, Henry Frederick. Speech consciousness among Egyptians and Babylonians. *Osiris* 2, part 2, 1-27, 1936. ISIS

Meek, Theophile J. The orientation of Babylonian maps. *Antiquity* 10, 223-26, 1 pl., 1936. ISIS

Neugebauer, Otto. Über eine Untersuchungsmethode astronomischer Keilschrifttexte. *Zeitschr. d. deutschen morgenl. Ges.* 90, 121-34, 7 fig., 1936. ISIS

A simple method eliminating tedious computations in the investigation of " linear zigzag-functions " such as the ephemerides or epimenides found on tablets. The method permits the investigator to connect tablets belonging to the same tabulation, disregarding the missing intervening tablets; in many cases, the method may be used for the dating of a text. A. P.

Schaumberger, J. Drittes Ergänzungsheft zu F. X. KUGLER, S. J., Sternkunde und Sterndienst in Babel. viii + 152 p., 17 pl. Münster i. W., ASCHENDORF, 1935. ISIS

Very elaborate review by OTTO NEUGEBAUER, *Quellen und Studien zur Gesch. d. Math., Astron. u. Physik* 3, 271-86, 6 fig., 1936.

Thureau-Dangin, F. Textes mathématiques babyloniens. *Revue d'assyriologie et d'archéologie orientale* 33, 65-84, 1936. ISIS

" Les trois tablettes mathématiques, transcrites ci-dessous, remontent au temps de la première dynastie babylonienne. Les deux premières ont été publiées en autographie et phototypie par NEUGEBAUER. De la troisième qui a été publiée en autographie par DOSSIN on trouvera ci-dessous une reproduction photographique." P. 83-84, discussion d'équations bicarrées (problème XII de BM 13901). G. S.

Thureau-Dangin, F. Notes sur la mathématique babylonienne. *Revue d'assyriologie et d'archéologie orientale* 33, 161-68, 1936. ISIS

4. — GREECE

Baumann, E. D. Der spasmos kunikos der Antiken. *Janus* 40, 34-42, 1936. ISIS

Doutzaris, P. La rythmique dans la poésie et la musique des grecs anciens. *Revue des études grecques* 47, 297-345, 1934. ISIS

Flickinger, Roy C. The Greek theater and its drama. xxviii + 385 p. University of Chicago Press, 1936 ($ 5.00). ISIS

The fourth edition of Professor FLICKINGER's scholarly and comprehensive study of the environment and machinery of the Greek theatre. Two and a half pages of additional notes and a new photograph serve to keep the book abreast of the latest developments in the subject. It is a pity that the University of Chicago Press which is generally distinguished for such excellent bookmaking should have printed this book on such inappropriate paper, the sort of paper that absorbs ink and retains it unevenly. M. F. A.-M.

Klein, Jacob. Die griechische Logistik und die Entstehung der Algebra. II. Teil. *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abtg. B : Studien 3, 122-235, 1936. ISIS

Koukoules, Phaidon. The Athens modern-Greek lexicon. *Journal of Hellenic studies* 53, 1-15, 6 fig., 1933. ISIS

Lagercrantz, Otto. Ein alchemistisches Rezept. *Symbolae Osloenses* 14, 5 p., 1935. ISIS

New interpretation of the alchemical recipe included by BERTHELOT in his *Alch. gr.* 309, 3-9. G. S.

Martin, Victor. Une tablette magique de la bibliothèque de Genève. *Genava*, vol. 6, 56-64, 1928. ISIS

Tablette en plomb du Musée de Genève, achetée en Égypte. Le texte grec est édité. G. S.

Natanson, Wladyslaw. W. Aleksandrji. 27 p. Odbitka z "Przeglądu Wspólczesnego" Nr. 139, Listopad 1933 (in Polish). ISIS

On science in Alexandria (in Polish). G. S.

Steele, Arthur Donald. Über die Rolle von Zirkel und Lineal in der griechischen Mathematik. *Quell. u. Stud. z. Gesch. d. Math., Astro. u. Phys.* Abtg. B : Studien, 3, 287-363, 1936. ISIS

5. — ROME

Grimm, Dr. Ein Arztbesteck der römischen Zeit von Aschersleben, Kr. Aschersleben. *Arch. für Geschichte der Medizin* 29, 104-09, 3 fig., 1936. ISIS

Kay, Ivy L. A table-top of ancient Roman marbles. *Natural history magazine* 5, 280-92, 1936. ISIS

Notes on 162 specimens of ornamental stones, excavated from ancient tombs on the Via Appia in 1850-3, and formed into a table-top now in the British Museum of Natural History. C. W. A.

Tabula Imperii Romani. *Geographical journal* 86, 523-26, 1935. ISIS

Report on work accomplished on the 1/million map of the Roman Empire. C. W. A.

Schanz, Martin (1842-1914). Geschichte der römischen Literatur bis zum Gesetzgebungswerk des Kaisers JUSTINIAN. II. Tl. : Die römische Literatur in der Zeit der Monarchie bis auf HADRIAN. 4. neubearb. Aufl. von CARL HOSIUS. xvii + 886 p. (*Handbuch d. klass. Altertumswiss.* 8. Abt., 2. Tl.). München, BECK, 1935. ISIS

Taylor, Alfred J. The Roman baths of Bath. Catalogue of antiquities discovered during excavations on the site of the Roman Thermae at Bath, with illustrations and plan of the Roman baths. 52 p. Bath, Mendip Press, 1933. ISIS

II. — MIDDLE AGES

6. — **MIDDLE AGES** (*generalities*)

Destrez, Jean. La pecia dans les manuscrits universitaires du XIII^e^ et du XIV^e^ siècle. 2 vols. in large quarto, 104 p. and album of plates. Paris, VAUTRAIN, 1935. ISIS

Reviewed by LYNN THORNDIKE, *Isis* 25, 155-57, 1936.

Dobrowolski, Kazimierz. Science and scholarship in Poland up to the close of the XVIth century. *Organon* 1, 43-110, 1936. ISIS

Gilson Etienne. Le moyen âge et le naturalisme antique. *Archives d'histoire doctrinale et littéraire du moyen âge* 7, 5-37, 1932. ISIS

Gilson, Etienne. Les sources gréco-arabes de l'Augustinisme avicennisant. *Archives d'histoire doctrinale et littéraire du moyen âge* 4, 5-149, 1929. ISIS

Homans, George C. Men and the land in the Middle Ages. *Speculum* 11, 338-51, 1936. ISIS

Lottin, Dom Odon. La doctrine morale des mouvements premiers de l'appétit sensitif aux XII^e^ et XIII^e^ siècles. *Archives d'histoire doctrinale et littéraire du moyen âge* 6, 49-173, 1931. ISIS

Maresch, Gustav. Zur SATOR-Formel. *Commentationes Vindobonenses* 1, 94-7, 1935. ISIS

" Einleitend über F. GROSSERS (1926) und S. AGRELLS (1927) Deutung der Formel aus dem Paternoster-Kreuz. Sodann über neue archäologische Funde. Schliesslich eigene Deutung dass in SATOR das griech. SOTER steckt und dass vielleicht die Formel gnostischen Ursprunges ist. E. DARMSTAEDTERS SATOR-Arbeit ist Verf. wohl entgangen." Also see *Isis* 24, 107.

Thorndike, Lynn. Alchemical writings in Vatican Palatine and certain other continental Latin manuscripts. *Speculum* 11, 370-83, 1936. ISIS

III. — ORIENTAL SCIENCE AND CIVILISATION

8. — WESTERN ASIA

(including " The ancient East," in general)

Albright, W. F. How well can we know the ancient Near East? *Journal of the American oriental society* 56, 121-44, 1936. ISIS

Includes a very valuable history of research accomplished during the last century. G. S.

Burrows, Eric. The origin of the Ras Shamra alphabet. *Journal of the Royal Asiatic Society* 271-77, 1936. ISIS

" It can hardly be doubted that the derivation of the Ras Shamra cuneiform from the earlier Semitic alphabet is correct. It remains to determine to what stage of the development of the Sinaitic-Canaanite-Phoenician alphabet the alphabet of Ras Shamra corresponds; and to re-investigate the origin of certain signs in the latter."

Percival, John. Cereals of ancient Egypt and Mesopotamia. *Nature* 138, 270-73, 6 fig., 1936. ISIS

EASTERN ASIA

(Including works relative to the whole of Buddhist Asia, or to India, Central and Eastern Asia combined)

Berg, C. C. The study of Javanese literature in India. Some critical remarks. *Annual Bibliography of Indian archaeology for the year* 1934, Kern Institute—Leyden, 39-50, 1936. ISIS

Apropos of H. B. SARKAR's book *Indian influences on the literature of Java and Bali* (Greater India studies, no. 1, published by the Greater India Society, Calcutta, 1934).

Pritchard, Earl H. Bulletin of Far Eastern bibliography, vol. 1, no. 1, ii + 21 p. (mimeographed), Feb. 1936. Published by the Committees on Far Eastern Studies of the American Council of Learned Societies, Washington, D. C., 1936. ISIS

9. — INDIA

Bailey, T. Grahame. Judge H. T. COLEBROOKE's supposed translation

of the Gospels into Hindi, 1806. *Journal of the royal asiatic society*, 491-99, 1936. ISIS

Das, Sukumar Ranjan. Scope and development of Indian astronomy. *Osiris* II, pt. 7, 197-219, 1936. ISIS

Contents : Astronomy in the Vedas; Jyōtiṣa Vedāṅga; 500 B.C. to 500 A.D. Probable date of composition of the Saṃhitās and the older Siddhāntas; Indian spherical astronomy from sixth century A.D.; Developments of Indian astronomy in the Vedas; in the Brāhmaṇas; in the Vedāṅga Jyōtiṣa; in the Jyōtiṣa Saṃhitās; in the Siddhāntas; General scope of Indian astronomy.

Eliade, Mircea. Yoga. Essai sur les origines de la mystique indienne. ix + 343 p. (Bibliothèque de philosophie roumaine). Paris, GEUTHNER, 1936. ISIS

Kern Institute, Leyden. Annual bibliography of Indian archaeology for the year 1934, vol. IX, x + 166 p., 8 pl., 11 fig. Leyden, BRILL, 1936. ISIS

This bibliography, compiled with considerable care and completeness cannot be praised too highly. However, the lack of a special section on Hindu science is regrettable. G. S.

Prasad, Gorakh. On the age of the Baudhâyana śrauta sûtra. *Journal of the royal asiatic society*, 417-21, 1936. ISIS

Singh, Avadhesh Narayan. A review of Hindu mathematics up to the 12th century. *Archeion* 18, 43-62, 1936. ISIS

10. — CHINA

Bernard, Henri (S. J.) Les étapes de la cartographie scientifique pour la Chine et les pays voisins depuis le XVI[e] jusqu'à la fin du XVIII[e] siècle. *Monumenta serica*, Journal of oriental studies of the Catholic University of Peking, 1, 428-77, 2 maps, 1935. ISIS

" Bien que l'on ait beaucoup écrit au sujet de la cartographie chinoise, il reste encore plus à dire. En particulier, pour les quatre derniers siècles, des documents essentiels n'ont pas encore été édités, et, tandis que certains épisodes (comme le levé de la grande carte de K'ANG-HI) ont reçu un traitement de faveur, d'autres événements non moins importants (tels que la première mesure d'un degré de longitude) sont restés presque complètement ignorés. L'inventaire des cartes chinoises de cette époque est à peine ébauché. Quant aux publications modernes, elles sont éparpillées dans des ouvrages rares et dispendieux, ou dans des revues difficilement accessibles. Pour ces motifs,

nous avons cru qu'il était utile de rassembler en une étude d'ensemble, dépourvue des détails trop techniques, tout ce qui nous a paru propre à éclairer cet épisode instructif des relations amicales et de la collaboration fraternelle entre l'Occident et l'Extrême-Orient. Dès l'abord, ce qui surprend les chercheurs, c'est l'exubérante richesse et l'incroyable exactitude des cartes chinoises." Contents : 1. Depuis la venue des Portugais (1514) jusqu'à l'arrivée du Père RICCI (1582); 2. Depuis l'arrivée du Père RICCI en Chine (1582) jusqu'à la publication de l'atlas de MARTINI; 3. Depuis la majorité de K'ANG-HI jusqu'à sa mort; 4. La carte de l'Asie sous KI'EN-LONG.

Charr, Robert. Ancient Chinese medicine. *Annals of medical history* 8, 242-48, 1936. ISIS

Chiu, Kaiming (CH'IU K'AI-MING). The introduction of spectacles into China. *Harvard journal of Asiatic studies* 1, 186-93, 1936. ISIS

" The earliest systematic discussion by a Westerner on the introduction of spectacles into China known to the writer is that by BERTHOLD LAUFER, in his article " Zur Geschichte der Brille " in *Mitteilungen zur Geschichte der Medizin* 6 (1907), 379-385. This article was used by Dr. GEORGE SARTON as the principal source for his account of the introduction of spectacles into China in his *Introduction to the history of science* 2, 1024-1025. Through the kind suggestion of Dr. SARTON I was recently led to this interesting topic, my object at first being merely to identify for him a few Chinese characters for the Chinese titles and authors mentioned by LAUFER, which Dr. SARTON said that he had been unable to elicit from LAUFER for many years. My research, however, has led me deeper and deeper into the subject until I have found all the Chinese sources used by LAUFER, whereupon I find quite a few mistakes as to the facts given in his article and as to the actual Chinese characters given in Dr. SARTON's account, which he himself has felt doubtful about for some time." Dr. CHIU has entirely renewed the question. The term *ai-tai* is probably of foreign origin, possibly Arabic *'uwainât*. G. S.

Chung-Hua-Min-Kuo Hsin Ti-Tu. A new atlas of China. Shanghai, Shen Pao Press, 1934. ISIS

Reviewed by G. B. BARBOUR, *Geographical journal* 87, 177-78, 1936. " The main series of 42 areal maps is preceded by seven distributional charts, and followed by 58 city maps and 180 pages of gazetteer of 33,000 place-names in Chinese characters." C. W. A.

Eberhard, Wolfram ; Mueller, Rolf. Contributions to the astronomy of the Han period III. Astronomy of the later Han period. *Harvard journal of Asiatic studies* 1, 194-241, 1936. ISIS

Escarra, Jean. Le droit chinois. Conception et évolution, institutions législatives et judiciaires, science et enseignement. xii + 559 p. Pékin, Editions HENRI VETCH, Librairie du Recueil Sirey, Paris, 1936 (18 dollars chinois ; 95 francs français). ISIS

" Voici un quart de siècle que la Chine a entrepris une œuvre de réorganisation législative et judiciaire dont l'importance est universelle. Le moment est venu de faire le point. Ce livre est un ouvrage d'information sommaire. Je n'ai d'ailleurs pas perdu de vue l'utilité qu'il pouvait offrir pour faire connaître, dans un domaine spécial, bien que fort vaste, la condition véritable de la Chine, condition qu'une propagande hostile représente souvent sous un aspect inexact. Je souhaite aussi que ces études, élémentaires et dépourvues de caractère scientifique, suggèrent à quelques chercheurs l'idée de créer une véritable ' sinologie juridique.' Il est superflu d'ajouter que mon travail ne saurait, à aucun titre, se réclamer de cette discipline." ... " Mais un travail limité au droit positif n'offrait qu'un intérêt insuffisant. Plus instructives sont les observations qu'il est possible de faire, tant sur la conception philosophique du droit qu'ont édifiée, au cours des siècles, les Chinois, que sur le développement de leurs institutions. La première partie du livre et les notions historiques très élémentaires figurant en tête des trois autres parties se rattachent à cette remarque." ... " Si, dans mes constatations comme dans mes conclusions, le souci d'une stricte objectivité a été ma seule règle, j'ai le devoir de dire, au seuil de ce livre, que l'œuvre immense accomplie en Chine, depuis vingt-cinq ans, en matière législative et judiciaire, commande le respect et, sur plus d'un point, l'admiration en dépit de lacunes et d'imperfections inévitables, bien souvent grossies par des observateurs de mauvaise foi." ... " L'ouvrage comporte une bibliographie sommaire, contenant environ huit cents références, un index détaillé, et des additions qui mettent le livre à jour au 31 décembre 1935. Les caractères chinois sont donnés toutes les fois qu'il est nécessaire, suivis de leur romanisation conforme au système officiel français."

Herrmann, Albert. Historical and commercial atlas of China. 112 p. (Harvard-Yenching Institute, monograph series, 1). Cambridge, Mass., Harvard University Press, 1935. ISIS

Elaborate atlas including many historical maps of China which have been compiled with considerable care (see list of sources on pp. 85-7) and elaborately indexed. The atlas will be very precious to every student of Chinese antiquity. After the Chinese names of the Index, numbers in square brackets refer to the Chinese characters, 2922 which have been printed on five plates : a very remarkable solution of a vexing problem. However, these numbers do not correspond with those of any system known to me. It would have been better to use the Giles numbers. The printing of the maps is very good, but some maps do not open flat enough and the central part is difficult to read. G. S.

Licent, Emile (S. J.). Vingt deux années d'exploration dans le Nord

de la Chine, en Mandchourie, en Mongolie et au Bas-Tibet (1914-1935). Le Musée Hoang ho Pai ho de Tientsin. 41 p., ills., maps. Tientsin, Mission de Sienhsien, 1936. ISIS

Résumé de l'œuvre immense du Père LICENT—œuvre d'explorateur, de naturaliste, de préhistorien (*Isis* 23, 272), de créateur de musée—avec un catalogue de ses nombreuses publications. G. S.

Médard, M. Le *Choei-king tchou* et l'ancienne géographie Indochinoise. xl + 67 p., 1 pl., 3 maps. Pékin, imprimerie des Lazaristes, 1935. ISIS

Reviewed in *Journal of the American oriental society* 56, 96, 1936. "The *Shui ching*, or 'Water classic' is the earliest treatise on the water-courses of China. A work of this name by SANG CH'IN is known to have existed at the beginning of our era, because it is quoted by PAN KU, but the present work of that name was probably written during the Three kingdoms period. The first commentary on it was written by LI TAO-YÜAN, of the Northern Wei period, and is of more value than the classic itself. It is the commentary with which M. MÉDARD is concerned. A good deal of work has been done on the 'Water classic' by critical scholars of the Manchu period. This study is limited to Indo-China."

Rock, J. F. The story of the flood in the literature of the Mo-so (na-khi) tribe. *Journal of the West China Border Society* 7, 64-80, 7 pl., 2 fig., 1935. ISIS

Rudakov, A. V.; Marakuev, A. V. Dappled deer in the Chinese pharmacopoeia (in Russian with German synopsis). ISIS

Reviewed by S. E., *Harvard journal of Asiatic studies*, 1, 260, 1936.

Sarton, George. Chinese glass of the beginning of the Confucian age. *Isis* 25, 73-9, 1936. ISIS

Wên-Jên, Liao. Shina chûsei igaku shi (History of Chinese medicine in the Middle Ages). 466 p., 1 facs., Kyoto, Kaniya shoten, 1932.

Reviewed by SHIO SAKANISHI, *Isis* 25, 158, 1936.

11. — JAPAN

Brachwitz, Richard. Das Shoso-in Museum der Ksl. Schatzkammer zu Nara und seine Heilmittel. *Isis* 25, 63-72, 1936. ISIS

Kuwaki, Ayao. The development of scientific ideas in Japan. pp. 507-21. (No date or place, received in May 1936) (in Japanese). ISIS

Rufus, W. Carl ; Lee, Won-Chul. Marking time in Korea. *Popular astronomy* 44, 252-57, 3 figs., 1936. ISIS

Concerning the calendar and time-measuring instruments. A. P.

Sakanishi, Shio. The (study of the) history of science in Japan. *Isis* 25, 137, 1936. ISIS

12. — ISRAEL

(*Including works devoted to Palestine*)

Glueck, Nelson. Explorations in Eastern Palestine, II. The Annual of the American schools of oriental research. Vol. XV for 1934-35, pp. 1-202, with many illustrations. New Haven, American schools of oriental research, 1935. ISIS

Elaborate exploration of Edom, more than 250 sites being examined and their dates established by means of the sherds found on them. Contains much valuable information on iron and copper ores and early metallurgy. This substantiates *Deut.* 8, 9, which describes the Holy Land as " a land whose stones are iron, and out of whose hills you can dig copper." See the author's interesting conclusions, too long to be quoted, on pp. 137-40. G. S.

Minkin, Jacob S. The romance of Hassidism. viii + 398 p. New York, MACMILLAN, 1935. ISIS

Reviewed by SOLOMON GANDZ, *Isis* 25, 159-64, 1936.

Munktell, Henrik. La loi mosaïque et son influence sur le développement de la législation suédoise. *Lychnos* 1, 131-49, 1936 (in Swedish, with French summary, pp. 149-50). ISIS

" La loi mosaïque a exercé, pendant une longue période de l'histoire, une grande influence sur le développement de la législation suédoise. La Réforme marque une première étape décisive de cette influence. Jusqu'à cette époque elle se manifestait entièrement par l'intermédiaire du droit canonique. Autrefois il y avait indéniablement une certaine tendance, dans le domaine de la recherche jurisprudentielle suédoise et germanique en général, à considérer nos plus anciennes sources législatives écrites comme étant primordiales et exprimant dans leur ensemble le droit germanique primitif. La réaction manifestée contre cette thèse contribue à démontrer l'influence exercée par la loi mosaïque. Déjà dans la préface du code d'Upland on rencontre le nom de Moïse. La loi du talion qu'on observe dans les lois de province ne semble également pouvoir être expliquée que par l'influence de la loi mosaïque transmise par le droit canonique On peut aussi, pour ce qui concerne cette époque, renvoyer au traitement des crimes contre les mœurs.

Neuburger, Max. Die stellung der jüdischen Aerzte in der Geschichte der medizinischen Wissenschaften. *Mitteilungsblatt der Vereinigung jüdischer Ärzte*, Nr. 28, 3-32, 1936. ISIS

13. — IRAN

Berthels, E. Bericht über die iranistischen und turkologischen Studien in Russland während der Jahre 1914-1920. *Islamica* 3, 305-18, 1927. ISIS

Christensen, Arthur E. Codices Avestici et Pahlavici bibliothecae universitatis Hafniensis. Vol. I: The Pahlavi codices K 20 and K 20*b*. Published in facsimile by the University Library of Copenhagen, with an introduction. xvi + 388 p., 1931. Vol. II: The Pahlavi codex K 26. viii + 106 p. Vol. 3 et 4: The Pahlavi codex, K 35. Published in facsimile with an introduction. Part 1, 7-265 p.; pt. 2, 8-98 p. Copenhagen, University Library, 1932-1934. ISIS

Reviewed by H. W. BAILEY, *JRAS*, 1001-03, 1933; by R. A. NICHOLSON, *JRAS* 123, 1936.

Christensen, Arthur E. Les Kayanides. 165 p. (Det Kgl. Danske Videnskabernes Selskab. Historisk-filologiske Meddelelser XIX, 2). Copenhagen, HOST, 1931. ISIS

Elgood, Cyril. Medicine in Persia. x + 105 p., 11 ills. (Clio medica). New York, HOEBER, 1934. ISIS

Reviewed by ARNOLD WILSON, *Journal of the royal Asiatic society*, 534-36, 1935.

(Geiger, Wilhelm). Studia Indo-Iranica. Ehrengabe für WILHELM GEIGER zur Vollendung des 75. Lebensjahres 1856-21. Juli, 1931. Herausgegeben von WALTHER WÜST. xii + 327 p., portrait, 5 fig., 2 pl. Leipzig, HARRASSOWITZ, 1931. ISIS

Analyzed in the *Critical Bibliography* of *Isis*.

Ghirshman, R. Notes sur les peuples et l'art de l'Iran préhistorique. *Revue des arts asiatiques* 10, 23-36, 8 fig., 1936. ISIS

Hertel, Johannes. Der Planet Venus im Awesta. (*Berichte Verhandlg. Sächs. Akad. Wiss.*, phil.-hist. Kl. 87). 107 p., Leipzig, HIRZEL, 1936. ISIS

Herzfeld, Ernst E. Archaeological history of Iran. xi + 112 p., 20 pl. (Schweich lectures on Biblical archaeology, 1934). London, Oxford University Press, 1935. ISIS

Herzfeld, Ernst. Iranische Denkmaeler. Reihe 1 : Vorgeschichtliche Denkmaeler ; Steinzeitlicher Huegel bei Persepolis. Lieferung 1 : 12 p., 18 pl. ; Lieferung 2 : pp. 13-18, pl. 19-30. Berlin, Reimer-Vohsen Verlag, 1932. ISIS

Reviewed by H. FRANKFORT, *Antiquity* 7, 364-65, 1933.

Laignel-Lavastine ; Naficy, Abbas. Aperçu de l'évolution générale de la médecine persane. *Bulletin de la société française d'histoire de la médecine* 27, 292-96, 1933. ISIS

Nyberg, Henrik Samuel. Texte zum mazdayasnischen Kalender. 86 p. (Uppsala Universitets Årsskrift, 1934). Uppsala, Lundequistska Bokhandeln, 1934. ISIS

Reviewed by E. BENVENISTE, *Journal asiatique* 225, 294, 1934.

Schwarz, Paul. Iran im Mittelalter nach den arabischen Geographen. 957-94 p.; Bd. VIII, Lfg. 7-8. p. 1247-1340. IX, Lfg. 1, 1341-1388. Stuttgart, PFEIFFER, 1896-1929 ; Stuttgart, KOHLHAMMER, 1934, 1935. ISIS

Wesendonk, Otto Günther von. Das Weltbild der Iranier. Geschichte der Philosophie in Einzeldərstellungen. Abt. 1 : Das Weltbild der Primitiven und die Philosophie des Morgenlandes, Bd. 1*a*. 354 p., 1 map. Munich, REINHARDT, 1933. ISIS

Wilson, Sir Arnold T. Persia. With an introduction by H. A. L. FISHER. xvi + 400 p. (The modern world series). London, BENN, 1932. ISIS

14. — ISLAM

(*also Arabia*)

Amari, Michele (1806-89). Storia dei musulmani di Sicilia. Seconda edizione modificata e accresciuta dall'autore, pubblicata con note a cura di CARLO ALFONSO NALLINO. Volume primo, xliii + 678 p. ; volume secondo, xx + 630 p. Catania, Prampolini, 1930-1935. ISIS

Bercher, L. Le " Kitāb al-waraqāt." Traité de méthodologie juridique musulmane. Traduit et annoté. *Revue tunisienne* 1, 93-105, 185-214, 1930. ISIS

Blatter, Ethelbert. Flora arabica, the botanical exploration of Arabia. *Records Bot. Survey of India* 8, 451-501, 1933. ISIS

Bloom, Asher. L'ostéologie d'ABUL QUASIM et d'AVICENNE. 71 p. Paris, LIPSCHUTZ, 1935. ISIS

Reviewed by MARCEL FOSSEYEUX, *Bulletin de la société française d'histoire de la médecine* 31, 128, 1936. Not seen by G. S.

Bräunlich, Erich. The well in ancient Arabia. ix + 159 p. Leipzig, Asia Major, 1926. ISIS

Reviewed in *Jewish quarterly review* 26, 256, 1936.

Brugsch, Mohammed; Kampffmeyer, Georg. Arabische Technologie der Gegenwart. Mitt. der Seminars für Orientalische Sprachen a. der Friedrich-Wilhelms-Universität zu Berlin, 29, 1-98, 1926; 30, 58-139, 1927. ISIS

Carruthers, Douglas. Arabian adventure. To the great Nafud in quest of the oryz. xii + 208 p., 33 pl., 2 maps. London, WITHERBY, 1935. ISIS

Chol, Ismā'īl Beg. The Yazīdīs past and present. (Publications of the faculty of arts and sciences, American University of Beirut, oriental series, 6). Beirut, American Press, 1934. ISIS

Reviewed by J. HEYWORTH DUNNE, *JRAS* 545, 1936.

Combe, Et. (et alii). Répertoire chronologique d'épigraphie arabe. Tome deuxième. viii + 276 p. (Institut français d'archéologie orientale). Le Caire, 1932. ISIS

Desparmet, Joseph. Ethnographie traditionnelle de la Mettidja. Le mal magique. 347 p. (Publications de la Faculté des Lettres d'Alger, ancien Bulletin de Correspondance Africaine, vol. 63). Alger, 1932. ISIS

Devonshire, Henriette C. Quelques influences Islamiques sur les arts de l'Europe. 16 p., 81 ills. Cairo, 1929. ISIS

Donaldson, Dwight M. The Shi'ite religion. A history of Islam in Persia and Irak. xxvi + 393 p. (LUZAC's Oriental religions series, 6). London, LUZAC, 1933. ISIS

Dougherty, Raymond Philip. The sealand of ancient Arabia. xii + 203 p. (Yale Oriental series, 19). New Haven, Yale University Press, 1932. ISIS

Dozy, Reinhart Pieter Anne. Histoire des Musulmans d'Espagne jusqu'à la conquête de l'Andalousie par les Almoravides (711-1110). Nouvelle édition revue et mise à jour par E. LÉVI-PROVENÇAL. I-III. viii + 363 p.; iv + 347 p.; iv + 283 p., port. Leyden, BRILL, 1932. ISIS

Ebermann, W. Die medizinische Schule von Gundīsāpūr. Zapiski, Neue Folge, Bd. I, 47-72, 1925 (Eigenbericht des Verf. in *Islamica*, vol. 4, fasc. 2, 147-49) (Russisch). ISIS

Reviewed by M. MEYERHOF, *Mitteilungen zur Geschichte der Medizin* 30, 46-7, 1931.

Ecker, Lawrence. Arabischer, provenzalischer und deutscher Minnesang. Eine motivgeschichtliche Untersuchung. iv + 236 p. Bern, HAUPT, 1934. ISIS

Erlanger, Baron Rodolphe D'. La musique arabe. Tome deuxième : AL-FĀRĀBĪ. Livre III du *Kitābu'l mūsīqī al-kabīr*. Traduction française, et AVICENNE, *Kitābu š-šifā'* (Mathématiques, chap. XII) traduction française. 310 p. Paris, GEUTHNER, 1935 (85 frs.). ISIS

Nous avons rendu compte assez longuement du premier volume de cet ouvrage (1930; *Isis* 20, 280-3). Il suffira d'en indiquer la continuation. M. le Baron CARRA DE VAUX nous écrit à ce sujet : " Permettez-moi de vous signaler l'apparition du tome II de ' la Musique arabe ' publication qui a été longtemps retardée par la mort de son auteur, et aussi un peu par les difficultés des temps présents. Cet ouvrage a pour l'histoire des sciences un certain intérêt, en quelque sorte négatif; c'est-à-dire que les anciens théoriciens, tant grecs qu'arabes, ont tenu à relier la musique à l'arithmétique, mais ils ont beaucoup tâtonné dans leur constitution des gammes parce qu'ils avaient encore une manière trop gauche de calculer les fractions; leur science arithmétique n'était pas assez avancée. S'ils avaient pu avoir une notion nette des logarithmes, qu'ils ont très vaguement entrevus, nul doute qu'ils n'auraient choisi du premier coup un partage de l'octave en 12 demi-tons ou en 24 quarts de tons égaux. Quelques passages de cet

ouvrage intéressent aussi l'histoire de la physique." La traduction des textes arabes est suivie de notes assez étendues (p. 247-306) qui en expliquent la portée et élucident les difficultés mathématiques. G. S.

Fikry, Ahmad. L'art roman du Puy et les influences islamiques. 340 p., 61 pl., 335 fig. (Etudes d'art et d'archéologie). Paris, LEROUX, 1934. ISIS

Reviewed by LOUIS BRÉHIER, *Journal des savants*, 7-19, 1936.

Foley, H. Mœurs et médecine des Touareg de l'Ahaggar. Extrait des *Archives de l'Institut Pasteur d'Algérie*, vol. 8. Paris, LEROUX, 1930. ISIS

Fritsch, Erdmann. Islam und Christentum im Mittelalter. Beiträge zur Geschichte der muslimischen Polemik gegen das Christentum in arabischer Sprache. vii + 157 p. (*Breslauer Studien zur historischen Theologie*, 17). Breslau, MÜLLER und SEIFFERT, 1930. ISIS

Froehner, Reinhard. Arabische Kamelheilkunde des Mittelalters. *Arch. f. Tierheilkunde* 67, 358-61, 1934. ISIS

Gaudefroy-Demombynes, Roger. L'œuvre française en matière d'enseignement au Maroc. 247 p. Paris, GEUTHNER, 1928. ISIS

Reviewed by GABRIEL FERRAND, *Journal asiatique*, 214, 181-84, 1929.

Grimme, Hubert. Texte und Untersuchungen zur ṣafatenisch-arabischen Religion. Mit einer Einfuhrung in die ṣafatenische Epigraphik. 190 p., 15 pl. (Stud. z. Gesch. u. Kult. d. Altertums. Im Auftr. d. Gorres-Gesellsch. hrsg. v. E. DRERUP, H. GRIMME, J. P. KIRSCH, Bd. 16, H. 1). Paderborn, SCHÖNINGH, 1929. ISIS

Grohmann, Adolf. Arabische Papyri aus den Staatlichen Museen zu Berlin. Bd. 1, Tl. 1 : Protokolle und Rechtsurkunden. 68 p., 8 pl. (Sonderdruck aus *Der Islam* 22, 1-68). Berlin, DE GRUYTER, 1934. ISIS

Grohmann, Adolf. Südarabien als Wirtschaftsgebiet, zweiter Teil. x + 267 p. Brünn, ROHRER, 1933. ISIS

Grohmann, Adolf ; Arnold, Sir Thomas Walker (1864-1930). The Islamic book ; a contribution to its art and history from the VII-XVIIIth century. 2 parts : 1) The early Islamic period from

the VII-XIIth century, by A. GROHMANN (written in German, translated by J. ALLAN); 2) XIII-XVIII century by Sir T. ARNOLD. ISIS

Helfritz, Hans. Chicago der Wüste. 176 p., map, illus. Berlin, HOBBING, 1932. ISIS

Reviewed in *Geographical Review* 24, 510-12, 1934. Apropos of Ḥaḍramaut.

Herbigny, Michel d'. L'Islam naissant, notes psychologiques, pp. 177-325 des *Orientalia christiana*, XIV-2. Rome, Institut pontifical oriental, 1929. ISIS

Reviewed in *Revue des études islamiques*, 124-25, 1929.

Hogben, Sidney John. The Muhammadan emirates of Nigeria. xiv + 204 p., front. Oxford, University Press, 1930. ISIS

Iqbal, Sir Mohammad. The reconstruction of religious thought in Islam. vii + 192 p. Oxford University Press, 1934. ISIS

Reviewed by A. S. T., *Bulletin of the School of Oriental Studies* 7, 693-95, 1934; by D. S. MARGOLIOUTH, *JRAS*, 406-07, 1935.

Ivanow, Wladimir. A guide to Ismaili literature. xii + 138 p. (Prize publication fund, 13). London, Royal Asiatic Society, 1933. ISIS

Reviewed by PAUL KRAUS, *Revue des études islamiques*, année 1932, cahier 4, 483-90 (reçu en Oct. 1933); by RENÉ DUSSAUD, *Revue de l'histoire des religions* 108, 283-84, 1933.

Ivanow, Wladimir. Notes sur l' " Ummu'l-kitab " des Ismaëliens de l'Asie Centrale. *Revue des études islamiques*, 419-81, 1932. ISIS

Jarvis, Claud S. Yesterday and to-day in Sinai. xiv + 312 p. London, BLACKWOOD, 1931. ISIS

Johnson, M. C. Manuscripts of the Bagdad astronomers, 760-1000 A.D. *The observatory* 59, 215-26, 1 pl., 1 fig., 1936. ISIS

Kahle, Paul. Islamische Quellen zum chinesischen Porzellan. 45 p. *Zeitschr. d. Deutsch. Morgenl. Gesellsch.* Bd. 13. 1934. ISIS

Khan Durrani, F. The Ahmadiyya movement. 80 p. Lahore, India. The Ahmadiyya Anjuman-i-isha'at-i-Islam, 1926. ISIS

Kühnel, Ernst. Islamische Stoffe aus ägyptischen Gräbern in der islamischen Kunstabteilung und in der Stoffsammlung des Schlossmuseums. 91 p., 50 ills. (Hrsg. i. A.d. Generaldir. d. Staatl. Mus.). Berlin, WASMUTH, 1927. ISIS

Levy, Reuben. An introduction to the sociology of Islam. Vol. 2. v + 426 p. (HERBERT SPENCER's descriptive sociology continued by his trustees). London, WILLIAMS and NORGATE, 1933. ISIS

Reviewed by H. A. R. GIBB, *JRAS*, 158-61, 1935.

Lévi-Provençal, E. Les manuscrits arabes de l'Escurial. Décrits d'après les notes de HARTWIG DERENBOURG. Revues et mises à jour par E. LÉVI-PROVENÇAL. Tome III, Théologie, géographie, histoire. Paris, GEUTHNER, 1928. ISIS

Lewicki, T. Culte du BÉLIER dans la Tunisie musulmane. *Revue des études islamiques* 195-200, 1935. ISIS

Mamour, Peter Hagop. Polemics on the origin of the Fatimi caliphs. With introduction and index. 224 p. London, LUZAC, 1934. ISIS

Mayer, Leo A. Saracenic heraldry : a survey. xvi + 302 p., 71 pl. Oxford, Clarendon Press, 1933. ISIS

Reviewed by H. A. R. GIBB, *Bulletin of the School of oriental studies* 7, 426-29, 1934; by A. S. TRITTON, *JRAS*, 410-13, 1934.

Meyerhof, Max. A sketch of Arabic science. *Journal of the Egyptian medical association* 19, 462-74, 1936. ISIS

Meyerhof, Max. Sur le nom *dardār* (orme et frêne) chez les Arabes. *Bulletin de l'Institut d'Egypte*, 18, 137-49, 1936. ISIS

Examen fort érudit d'un sujet très compliqué. L'auteur conclut : " Il faut en traduisant le nom *dardār*, prendre en considération l'auteur et l'époque auxquels appartiennent les textes, le pays où pousse l'arbre et la langue dans laquelle il est désigné par des synonymes supplémentaires." G. S.

Miller, Konrad. Mappae Arabicae : Arabische Welt- und Länderkarten, V. Bd., Weltkarten und Nachträge zu den Länderkarten,

pp. 99-184, Beiheft, Islam-Atlas. Tafel 64-79, 82. Stuttgart, Author, Stafflenbergstr. 54. 1931. ISIS

Reviewed by GABRIEL FERRAND, *Journal asiatique*, 220, 354-56, 1932. See review of the first parts of same work, 1926 sq. in *Isis* 9, 458-62, etc.

Moberg, Axel. An-nasī' (Koran 9, 37) in der islamischen Tradition. 54 p. (Lunds Universitets årsskrift, 27). Lund, GLEERUP, 1931. ISIS

Reviewed by J.-M. FADDEGON, *Journal asiatique* 225, 311-14, 1934. Contribution to the study of the Muslim calendar. G. S.

Moberg, Axel. Über einige christliche Legenden in der islamischen Tradition. 38 p. Lund, H. Ohlssons, 1930. ISIS

Montgomery, James Alan. Arabia and the Bible. x + 207 p. Philadelphia, University of Pennsylvania Press, 1934. ISIS

Mordtmann, Johannes Heinrich; Mittwoch, Eugen. Sabäische Inschriften, xvi + 270 p., ills., maps. (Bathjens-v. Wissmannsche Südarabien-Reise, Bd. 1). Hamburg, FRIEDERICHSEN, 1931. ISIS

Reviewed by MARCEL COHEN, *Journal asiatique* 223, f. a., 176-78, 1933.

Mordtmann, Johannes Heinrich; Mittwoch, Eugen. Himjarische Inschriften in den Staatlichen Museen zu Berlin. viii + 78 p., 28 pl. (*Mitteilungen der Vorderasiatisch-Ägyptischen Gesellschaft*, 37). Leipzig, HINRICHS, 1932. ISIS

Muller, Victor. En Syrie avec les Bédouins. Les tribus du désert. xii + 347 p., 3 pl. Paris, LEROUX, 1931. ISIS

Reviewed by R. DUSSAUD, *Syria* 13, 217, 1932.

Murray, George William. Sons of Ishmael : a study of the Egyptian Bedouin. xv + 344 p., 32 pl. London, ROUTLEDGE, 1935. ISIS

Reviewed by C. G. SELIGMAN, *Nature* 137, 167-68, 1936.

Ostrup, J. Orientalische Höflichkeit. Formen und Formeln im Islam. Eine kulturgeschichtliche Studie. vi + 85 p. Leipzig, HARRASSOWITZ, 1929. ISIS

Paret, Rudi. Der Ritter-Roman von 'UMAR AN-N'UMĀN und seine

Stellung zur Sammlung von Tausendundeine Nacht. Ein Beitrag zur Arabischen Literaturgeschichte. 48 p., Tübingen, MOHR, 1927. ISIS

Paret, Rudi. Zur Frauenfrage in der arabisch-islamischen Welt. iv + 70 p. (Veröffentl. d. Oriental. Seminars d. Universität Tubingen). Stuttgart, KOHLHAMMER, 1934. ISIS

Pauty, Edmond. L'architecture musulmane au Maroc. 60 p., 64 pl., Paris, VAN OEST, 1931. ISIS

Pauty, Edmond. Les Hammams du Caire. viii + 62 p., 12 pl., 22 fig. (Mémoires des membres de l'Institut français d'archéologie orientale, 64). Le Caire, Imprimerie de l'Institut, 1933. ISIS

Reviewed by H. DEVONSHIRE, *JRAS* 136-37, 1936.

Philby, Harry St. John B. The empty quarter; being a description of the Great South Desert of Arabia known as Rub'al Khali. xxiv + 432 p., maps, ills. New York, HOLT, 1933. ISIS

Reviewed in *Geographical Review* 24, 510-12, 1934.

Philby, H. St. J. B. Arabia. xx + 364 p. London, BENN, 1930. ISIS

Reviewed by H. A. R. GIBB, *Bull. of the school of oriental studies* 6, 794-95, 1931.

Pines, Salomon. Beiträge zur islamischen Atomenlehre. 149 p. Berlin, HEINE, 1936. ISIS

" Der erste Teil dieser Schrift enthält eine Darlegung der Atomenlehre des Kalām nach den ältesten Quellen. Im zweiten Teil werden die physikalischen Lehren des MUḤAMMAD B. ZAKARIYYĀ AL-RĀZĪ behandelt und die Beziehungen die sie mit antiken Theorien verbinden, untersucht; anschliessend wird kurz auf die verwandten Anschauungen, die uns in der späteren islamischen Philosophie entgegentreten, eingegangen. Der dritte Teil ist der Erörterung der Antworten, die auf die Frage nach dem Ursprung der Atomenlehre des Kalām sich darbieten, gewidmet."

Raswan, Carl Reinhard. The black tents of Arabia (My life amongst the Bedouins). 280 p., maps, ills. London, HUTCHINSON, 1935. ISIS

Reviewed in *Geographical review* 25, 522, 1935.

Rathjens, Carl ; Wissmann, Hermann v. Landeskundliche Ergebnisse (*Rathjens-v. Wissmannsche Südarabien-Reise*, 3). xvi + 229 p., maps, ills. (Hamburgische Universität, *Abhandl. aus dem Gebiet der Auslandskunde*, 40). Ser. B, vol. 20. Hamburg, DE GRUYTER, 1934. ISIS

Reviewed in *Geographical review* 25, 521, 1935.

Rathjens, Carl ; Wissmann, Hermann v. Vorislamische Altertümer. xvi + 212 p., 327 ills. (*Rathjens-v. Wissmannsche Südarabien-Reise*, 2—Hamburgische Universität, Abhdg. aus dem Gebiet des Auslandskunde, 38). Hamburg, 1932. ISIS

Reviewed by H. A. R. GIBB, *Bulletin of the School of oriental studies* 7, 218, 1933; by A. S. TRITTON, *Antiquity* 10, 246, 1936.

Renaud, Henri Paul Joseph. L'introduction des drogues végétales américaines dans la matière médicale des Arabes. Actes, conférences et communications du III[e] Congrès international d'histoire des sciences, tenu au Portugal en 1934, 12 p., Lisbon, 1936. ISIS

Renaud, Henri Paul Joseph. Les maladies pestilentielles dans l'orthodoxie islamique. *Bull. de l'Institut d'hygiène du Maroc*, 16 p., 1934. ISIS

Reviewed by RAYMOND NEVEU, *Bull. de la soc. franç. d'hist. de la méd.* 29, 124-26, 1935.

Reusch, Richard. Der Islam in Ostafrika, mit besonderer Berücksichtigung der muhammedanischen Geheimorden. xii + 360 p. Leipzig, KLEIN, 1931. ISIS

Richter, Gustav. Studien zur Geschichte der älteren arabischen Fürstenspiegel. (Breslauer Dissertation). viii + 115 p. (*Leipziger Semitistische Studien*, N. F. Bd. 3). Leipzig, HINRICHS, 1932. ISIS

Ritter, Hellmut. AL-ḤASAN IBN MŪSĀ AN-NAUBAKHTĪ : Die Sekten der Schi'a. xxx + 114 p. Istanbul, Staatsdruckerei, 1931. ISIS

Reviewed by F. KRENKOW, *JRAS* 853-55, 1934.

Riza Nour Bey. Turk Tarekhe (Histoire turque). Vol. 1-12, fig.,

maps, plans. (Publications du ministère de l'Instruction publique, nº 54). Constantinople, Imprimerie Nationale, 1342-44 (1924-1926). ISIS

Reviewed by LUCIEN BOUVAT, *Journal asiatique*, 211, 355-58, 1927.

Robson, James. Christ in Islam. 128 p. London, MURRAY, 1929. ISIS

Sanhoury, A. Le califat, son évolution vers une société des nations orientales (Travaux du Séminaire oriental d'études juridiques et sociales, publié sous la direction de EDOUARD LAMBERT, vol. 4). xvi + 627 p. Paris, GEUTHNER, 1926. ISIS

Reviewed by GABRIEL FERRAND, *Journal asiatique*, 214, 186-7, 1929.

Sidersky, David. Les origines des légendes musulmanes dans le Coran et dans les vies des prophètes. viii + 162 p. Paris, GEUTHNER, 1933. ISIS

Reviewed by D. S. MARGOLIOUTH, *JRAS* 821-22, 1934.

Smith, Margaret. Studies in early mysticism in the Near and Middle East, being an account of the rise and development of early Christian mysticism in the Near and Middle East up to the seventh century, and of the subsequent development of mysticism in Islām known as Sūfism, together with some account of the relationship between early Christian mysticism and the earliest form of Islamic mysticism. ISIS

Spies, Otto. Beiträge zur arabischen Literaturgeschichte. x + 126 p. (Abhandlungen für die Kunde des Morgenlandes). Leipzig, BROCKHAUS, 1932. ISIS

Reviewed by F. KRENKOW, *JRAS*, 193-94, 1933.

Steiger, Arnald. Contribución a la fonética del hispano-árabe y de los arabismos en el ibero-románico y el siciliano. 519 p. (Centro de estudios históricos. *Revista de filología española*, 17). Madrid, HERNANDO, 1932. ISIS

Taner, F. Geographisches aus den Stambuler Bibliotheken (Arabische Handschriften). *Archiv Orientálni*, 6, 95-111, Praha, 1934. ISIS

Terrasse, Henri. L'art hispano-mauresque des origines au XIII^{e} siècle.

x + 506 p., 80 pl. (*Publications de l'Institut des Hautes études marocaines*, 25). Paris, VAN OEST, 1932. ISIS

Topf, Erich. Die Staatenbildungen in den arabischen Teilen der Türkei seit dem Weltkriege nach Entstehung, Bedeutung und Lebensfähigkeit. x + 260 p., ills. (Hamburg, Univ., *Abhandl. aus d. Gebiet d. Auslandskd.*, Bd. 31, Reihe A : Rechts- u. Staatswissensch., Bd. 3). Hamburg, Friederichsen, DE GRUYTER, 1929. ISIS

Tritton, Arthur Stanley. The caliphs and their non-Muslim subjects. A critical study of the covenant of 'UMAR. 240 p. Oxford, University Press, 1930. ISIS

Ünver, A. Süheyl. La place des Turcs dans la médecine islamique. *Tedavi kliniği ve laboratuvari*, 5, 7 p., Istanbul 1935. (in Turkish and French). ISIS

Ünver, A. Süheyl. Sur les ouvrages encyclopédiques en Orient. 14 p., 11 fig. *Türk i fizikî ve tabii ilimler cemiyeti arşivi*, no. 2, 1935 (in Turkish and French). Istanbul 1935. ISIS

Validi, A. Zeki. Considérations sur la collaboration scientifique entre l'Orient islamique et l'Europe. *Revue des études islamiques* 249-71, 1935 (publié en 1936). ISIS

Van der Meulen, Daniel ; Weissmann, H. von. Hadramaut : some of its mysteries unveiled. xxvi + 248 p., 97 ills., 2 maps. Leyden, BRILL, 1932. ISIS

Reviewed by D. S. MARGOLIOUTH, *Journal of the royal Asiatic society*, 370-71, 1934; in *Geographical review* 24, 510-12, 1934.

Vasmer, R. Chronologie der arabischen Statthalter von Armenien unter den Abbasiden, von AS-SAFFACH bis zur Krönung ASCHOTS I., 750-887. x + 118 p. (Studien zur armenischen Geschichte). Leipzig, HARRASSOWITZ, 1931. ISIS

Walzer, Richard. Über arabische Übersetzungen griechischer Autoren in Stambuler Bibliotheken. *Forsch. u. Fortschr.* 10, 391-92, 1934. ISIS

Wensinck, Arent Jan. Concordance et indices de la tradition

musulmane. Les six livres, le Musnad d'AL-DĀRIMI, le Muwaṭṭa' de MĀLIK, le Musnad de AḤMAD IBN ḤANBAL. Livraison I : abada-Allāhu (pp. 1-80), livraison 2 : Allāhu-barra (pp. 81-160). Union académique internationale. Leiden, BRILL, 1933-35. ISIS

Westermarck, Edward. Pagan survivals in Mohammedan civilization. viii + 190 p. London, MACMILLAN, 1933. ISIS

Reviewed by A. S. T., *Bulletin of the School of oriental studies* 7, 695-97, 1934.

Wiet, Gaston. Matériaux pour un Corpus inscriptionum Arabicorum, première partie : Egypte. Tome deuxième ; premier fascicule, 128 p. *Mémoires publiés par les membres de l'institut français d'archéologie orientale du Caire*, tome 52). Cairo, 1929. ISIS

Reviewed by A. R. GUEST, *JRAS*, 477-79, 1930.

Williams, Kenneth. IBN SA'UD. The Puritan king of Arabia. 299 p. London, CAPE, 1933. ISIS

Wilnai, Zeeb. History of the Arabs and the Muslims in Palestine. 2 vols. 180 p., 5 ills., 2 maps ; 192 p., 4 ills. Tel-Aviv, STYBEL, 1932. ISIS

Reviewed by D. S. MARGOLIOUTH, *JRAS*, 992-94, 1933.

Wright, Walter Livingston, jr. Ottoman statecraft, the book of counsel for vezirs and governors (Naṣâ'iḥ ül-vüzera ve'l-ümera) of SARI MEḤMED PASHA, the Defterdâr. Turkish text with introduction, translation, and notes. 172 p. (English) ; 123 p. (in Turkish). Princeton University Press, 1935. ISIS

PART III

SYSTEMATIC CLASSIFICATION

I. — SCIENCE IN GENERAL

16. — HISTORY OF SCIENCE

Académie internationale d'histoire des sciences. Comité international d'histoire des sciences, fondé en 1928. Annuaire, III,

1936. Statuts, membres, vœux. 64 p. Paris, au Secrétariat de l'Académie, 12 rue Colbert, 2e arr., 1936 (5 fr.). ISIS

Armitage, A. The teaching of the history of science in the University of London. *Lychnos* 1, 302-07, 1936. ISIS

Binoux, Prix. *Isis* 25, 136-37, 1936. ISIS

Brasch, Frederick E.; Hudgens, Lavada. The history of science society and the DAVID EUGENE SMITH *Festschrift*. *Science* 83, 424-26, 1936. ISIS

Diepgen, Paul. Das Berliner Institut für Geschichte der Medizin und der Naturwissenschaften. *Lychnos* 1, 230-34, 1936. ISIS

Dobrowolski, Antoni Boleslaw. On the psychology of creative thought. *Organon* 1, 290-94, 1936. ISIS

History of science society. Program of Saint Louis meeting. January 2-3, 1936. *Isis* 25, 138-40, 1936. ISIS

Organon. International review, I. vii + 304 p. Published by the Mianowski Institute for the promotion of science and letters, editor: STANISLAW MICHALSKI, Warsaw, Staszic Palace, 1936. ISIS

" The *Organon*, the first volume of which we are offering to our readers, is to be devoted to the " science of Science." The term " Science " is used here in its broadest sense, including both Natural Science and Humanities, covering practically the whole field of organized knowledge. The idea of this publication owes its origin to the Mianowski Institute for the Promotion of Science and Letters; it is to be issued as an international organ corresponding to a Polish periodical, published by this Institute, since 1918, under the title ' Nauka Polska ' (Science and letters in Poland.) In the first stage of its existence the chief concern of ' Nauka Polska ' was to deal with practical questions of the organization of science in Poland. In the course of time, however, it came to include questions of theory as well, as practical activity generally gives rise to the need of a corresponding theory which is indispensable for the extension of this activity and for testing its usefulness. Thus ' Nauka Polska ' has gradually undertaken the treatment of various psychological problems, connected with creative research work, of the social conditions under which science has developed, and also of the question of the connection of science with other branches of civilization. (The table of contents annexed to the present volume gives the subject-matter of twenty volumes of ' Nauka Polska ' published till now.) "

The first volume—a very handsome book of over 300 p.—is analyzed in the 48th Critical Bibliography of *Isis*. It illustrates very well the dual purpose

of *Organon:* international and Polish, the explanation of general science and the history of Polish science. I am sorry it reached me too late to be listed in my *Study of the history of science.* G. S.

Osiris. Vol. I: A volume of studies on the history of mathematics and the history of science. Presented to DAVID EUGENE SMITH on his 76th birthday (Jan. 21, 1936). Edited by GEORGE SARTON, with the cooperation of R. C. ARCHIBALD, Miss B. M. FRICK, A. POGO. 777 p. Bruges, Saint Catherine Press, 1936. ($6; $5 to members of H.S.S.). ISIS

Reviewed in *The astrophysical journal* 84, 112, 1936; by N. T. BOBROVNIKOFF, *Popular astronomy* 44, 288-89, 1936; by H. BROWN, *Annals of science* 1, 235, 1936; by Sir THOMAS HEATH, *Nature* 137, 720-22, 1936; O. NEUGEBAUER, *Quell. u. Stud. z. Gesch. d. Math. Astron. u. Phys.*, Abtg. B: Studien, 3, 434-36, 1936.

San Francisco medical history seminar. *Isis* 25, 138, 1936. ISIS

Sarton, George. Forty-fifth critical bibliography of the history and philosophy of science and of the history of civilization (to December 1935). *Isis* 25, 176-317, 1936. ISIS

This forty-fifth Bibliography contains about 800 items. They have been kindly contributed by 12 scholars belonging to 3 different countries.

Sarton, George. Preface to volume XXV. Humanism versus grammar. *Isis* 25, 6-8, 1936. ISIS

Remarks made at the annual dinner of the American Council of Learned Societies, Hotel Mayflower, Washington, D.C., on January 31, 1936.

Sarton, George. The study of the history of science. 70 p. Cambridge, Harvard University Press, 1936 ($1.50). ISIS

Contents: The study of the history of science; Bibliography; I. Historical methods; II. Scientific methods; III. Chief reference books for the history of science. A. History and biography; B. Catalogues of scientific literature; C. Union lists of scientific periodicals; D. General scientific journals; IV. Journals and serials on the history of science; V. Treatises on the history of science; VI. Handbooks on the history of science; VII. Societies and congresses. A. History of science societies; B. National scientific societies; C. International congresses; Index.

Sarton, George. Introduction to the history of science. Vol. 1: From HOMER to OMAR KHAYYAM, xi + 839 p.; Vol. 2: From RABBI BEN EZRA to ROGER BACON, xxxv + 1251 p. Baltimore, WILLIAMS and WILKINS, 1927-31. ISIS

Reviewed by J. N., *Lychnos* 1, 331-34, 1936 (in Swedish); by CHARLES SINGER, *Times literary supplement*, July 18, p. 584-86, 1936.

Singer, Charles. One increasing purpose. The spirit of science in history. *The Times Literary Supplement*, London, July 18, 1936. ISIS

Leading article apropos of the works of LYNN THORNDIKE, GEORGE SARTON and J. R. PARTINGTON. G. S.

Woodbury, Robert S. The teaching of the history of science in an engineering school. *Annals of science* 1, 226-32, 1936. ISIS

17. — ORGANIZATION OF SCIENCE

(Internal organization is meant, see Isis 1, 195
For external organization, national or international, see section 55)

Comptes rendus du Congrès national des sciences, Bruxelles 1935. 2 vols. 1707 p., 200 fig., maps, 23 pl. On souscrit chez M. J. P. BOSQUET, Secrétaire général, 54, avenue Bel-Air, Uccle (300 Belgian francs). ISIS

Lee, Richard E. Man the universe builder. The backgrounds and foundations of the scientific technique. First revised edition. xix + 443 p., 4 pl., 10 tables, 16 fig. Baltimore, WILLIAMS and WILKINS, 1935 ($ 3.00). ISIS

This is a general survey of the entire field of modern science in relation to education, culture, social development, economics, philosophy, and religion. It was written as an orientation book, unifying in one system the physical and natural sciences from cosmology to psychology. Science is presented as a great system of concepts based on funded human experience. It is conceived as an entity to be adequately comprehended only as a whole. A sharp distinction is made between science and " over beliefs," legitimate and illegitimate. The techniques of science constitute the bulk of what is called civilization but science itself is not the " slut and drab of war and industry." Man is seen as a creature of his historical and geographical environment. The historical parts of this book are Part III—the development of modern scientific techniques as applied to the constitution of the universe, the abode of man, living systems, thinking systems, evolution as a unifying technique, the intellectual processes of conceiving the materials and the unity of science, and classification as a unifying device; Part IV—the historical backgrounds of man's scientific techniques, including the calendar of science; the early universe builders from the days of animism to the Renaissance; the great builders, GALILEO and NEWTON; natural science of the 18th century; the scientific age of the 19th century; the physical, mathematical, and functional theories of the foundation stones

of the universe; and the new universe, space, time, and relativity. The closing part is a special study of the primary stuff, treating of radiation, the new electromagnetic spectrum, the quantum theory, and the coupling of radiation with the electron, atom and molecule. As a whole the book is a splendid resumé, comprehensive in scope, well unified, and well balanced, except for the biological fields in which only a cursory survey is made. C. A. K.

Organisation de la science polonaise. *Organon* 1, 135-289, 1936. ISIS

18. — PHILOSOPHY OF SCIENCE

Barnard, Chester I. Mind in everyday affairs. An examination into logical and non-logical thought processes. An address delivered before Princeton University on March 10, 1936, in the Cyrus Fogg Brackett lectureship in applied engineering and technology. 40 p. Guild of Brackett lecturers, 1936. ISIS

Bavink, Bernhard. The natural sciences. An introduction to the scientific philosophy of today. Translated from the 4th German edition with additional notes and bibliography, by H. STAFFORD HATFIELD. xiii + 683 p., 87 ills. New York, Century, 1932 ($ 7.50). ISIS

This is an effort to synthesize idealistically the entire field of modern science along general and philosophic lines. It differs from some attempts in this direction in the large degree to which the author presents a summary of what to him are the most significant results. The book is a well-synthesized review of force and matter, cosmos and the earth, matter and life, and nature and man. Closing chapters deal with nature and culture characterized by freedom and change; the philosophy of technology, emphasizing it as a realm of value comparable with art, science, and religious ethics; and nature and judgments of value, in which scientific philosophy is correlated with aesthetic, moral, and religious values. It is a scholarly, comprehensive, and logical presentation. C. A. K

Bujak, Franciszek. The man of action and the student. *Organon* 1, 20-32, 1936. ISIS

Messac, Regis. Micromégas. 93 p. Nimes, La laborieuse (no date, received August 1936). ISIS

Essay on the literary repercussions of the scientific knowledge of the microscopic world. G. S.

Metzger, Hélène. L'a priori dans la doctrine scientifique et l'histoire des sciences. *Archeion* 18, 29-42, 1936. ISIS

Norris, O. O. The logic of science and technology. *Philosophy of science* 3, 286-306, 1936. ISIS

Ossowska, Marja ; Ossowski, Stanislaw. The science of science. *Organon* 1, 1-12, 1936. ISIS

Rozwadowski, Jan. La science, la religion et l'art. *Organon* 1, 13-19, 1936. ISIS

Vassiliev, S. F. Some features of the evolution of scientific theories (in memory of the 40th anniversary of ENGEL's death). *Archives of the history of science and technology* 8, 1-27, 1936 (in Russian with English summary). ISIS

II. — FORMAL SCIENCES (knowledge of forms)

20. — MATHEMATICS

Durand, Dana B. Notes on Dr. SARTON's article " The first explanation of decimal fractions " (*Isis* 23, 153-245, 1935) (section 77). *Isis* 25, 134-35, 1936. ISIS

Henderson, James. Bibliotheca tabularum mathematicarum. Being a descriptive catalogue of mathematical tables. Part I : Logarithmic tables, A. Logarithms of numbers. 208 p. (Tracts for computers, edited by KARL PEARSON, 13). Cambridge University Press, 1926 (9 s). ISIS

Very important publication the continuation of which is highly to be desired. Each item is very carefully described. G. S.

Menninger, Karl. Kulturgeschichte der Zahlen. Aus der Entwicklung unserer Zahlsprache, unserer Zahlschrift und des Rechenbrettes. x + 365 p., 170 fig. Breslau, HIRT, 1934. ISIS

Elaborate study with abundant illustrations but no references. G. S.

Moritz, Robert E. On the beauty of geometrical forms. *Scripta mathematica* 4, 25-35, 2 pl., 1 fig., 1936. ISIS

Nilsson, Nils Gustaf. The measurement of ships and mathematics. An historical survey. *Lychnos* 1, 235-47, 1936 (in Swedish, with English summary, pp. 248-50). ISIS

"It might be considered, whether the task of finding a method for determining the size of a ship for shipbuilding and taxation purposes—the tonnage measurement of present days—has not to a certain degree influenced the development of mathematical science. A study of the few primary sources available might perhaps give an answer to the question."

Sarton, George. The study of the history of mathematics. 103 p., figs. Cambridge, Harvard University Press, 1936 ($ 1.50). ISIS

Contents: The study of the history of mathematics; Note on the study of the history of modern mathematics; Bibliography: I. General treatises; II. Handbooks; III. Treatises devoted to the history of special branches of mathematics; IV. Mathematics in the nineteenth and twentieth centuries; V. Philosophy and methodology; VI. Bibliography: A. Guides; B. Encyclopaedias; C. Large catalogues; D. Journals; VII. Journals on the history of mathematics; VIII. Centres of research: A. Academies of science; B. Mathematical societies; C. International congresses; D. Institutes and libraries; Appendix. Biographies of modern mathematicians; Index.

Sergescu, Petre. Sur quelques aspects des mathématiques contemporaines. Actes, conférences et communications du III[e] congrès international d'histoire des sciences tenu au Portugal en 1934, 7 p., Lisbon, 1935. ISIS

Siddons, A. W. Progress. *Mathematical gazette*, 20, 7-26, 1936. ISIS

Progress in the teaching of mathematics in English schools during the last hundred years. C. W. A.

Simons, Lao Genevra. Bibliography of early American textbooks on algebra, published in the Colonies and the United States through 1850, together with a characterization of the first edition of each work. 68 p. (*Scripta mathematica studies*, 1). New York, Scripta mathematica, 1936. ISIS

"The first edition of each text is accompanied in this work by a statement giving its purpose, its special characteristics and its contents, in some cases, its history. While some of the books are as much alike as peas in a pod, in spite of claims by the author to the contrary, many of them stand out through the introduction of new topics, through the independence of treatment and applications, or through the eccentricity of the author. Crank works, works covering all possible topics, or just one or two topics were put out, a rich and varied fare. There is even one work prepared especially for the blind."

Vollgraff, J. A. Note on the history of the loxodrome. Addition to SARTON's article on STEVIN, *Isis* 21, 279, 1934). *Isis* 25, 136, 1936. ISIS

Windred, G. The interpretation of imaginary mathematical time. *Mathematical gazette* 19, 280-90, 1935. ISIS

Historical outline with references. C. W. A.

III. — PHYSICAL SCIENCES (Knowledge of inorganic nature)

23. — ASTRONOMY

Das, Sukumar Ranjan. Scope and development of Indian astronomy. *Osiris* II, pt. 7, 197-219, 1936. ISIS

See note under India.

Gundel, Wilhelm. Dekane und Dekansternbilder. Ein Beitrag zur Geschichte der Sternbilder der Kulturvölker. Mit einer Untersuchung über die altägyptischen Sternbilder und Gottheiten der Dekane von S. SCHOTT. *Studien der Bibliothek Warburg*, hrsg. von FRITZ SAXL, H. 19, x + 452 p., 33 pl. Glückstadt und Hamburg, AUGUSTIN, 1936. ISIS

Kopff, A. Star catalogues, especially those of fundamental character. *Monthly notices of the royal astronomical society* 96, 714-30, 1936. ISIS

Pogo, Alexander. The lunar saros series of the COLUMBUS eclipse of 1504 February 29-March 1. *Popular astronomy* 44, 353-63, 2 fig., 1936. ISIS

The eighth of a series of papers dealing with the periodicity of eclipses; see *Isis* 25, 589-90.

Sticker, B. Wo bleibt die Kenntnis der Sternphasen bei den Germanen? *Vierteljahrsschrift der astronomischen Gesellschaft* 71, 250-52, 1936. ISIS

Thorndike, Lynn. Astronomy at Paris around 1485 and 1360. *Humanisme et renaissance* 3, 165-68, 1936. ISIS

24. — PHYSICS

Cornell, E. S. Early studies in radiant heat. *Annals of science* 1, 217-25, 1936. ISIS

Kuwaki, Ayao. Magnet and amber in oriental science. *Shisô*, 169-87, Tokyo, Oct. 1935 (in Japanese). ISIS

Miller, Dayton Clarence. Anecdotal history of the science of sound. To the beginning of the 20th century. xii + 114 p. With illustrations. New York, MACMILLAN, 1935 ($ 2.50). ISIS

" The Acoustical Society of America held its eighth meeting at the University of Michigan in November, 1932, and the then President of the Society gave an evening address with the title : ' Anecdotal history of the science of sound, with some personal reminiscences.' More than the usual amount of bibliographical research was involved in the preparation of this address, much of which could not be presented at the time. The address, somewhat amplified, and with a bibliography added, is now presented in book form." ... " When the writer was in college there were four living great men of science who were conspicuous for their work in sound, HELMHOLTZ, KŒNIG, RAYLEIGH, and TYNDALL. In the American Physical Society, before the World War, there were four members who were differentiated from their fellows by a considerable devotion to the problems of acoustics, A. G. WEBSTER, WALLACE C. SABINE, G. W. STEWART, and the author. The war very greatly extended the interest in sound, and it is only since that time that there has been any large number of scientific men working in this field. Indeed, the Acoustical Society of America which is now so active, was founded as recently as December, 1928. It is probable that the greater number of the members have had no personal relations with acoustic events which occurred before the war, and as our acoustic journals are all very young, there is as yet but little historical background in the available literature."

Contents : 1. Greek and Roman science—harmonics and acoustics; 2. Sound in the 16th and 17th centuries—experimentation; 3. Sound in the 16th and 17th centuries—music; 4. Sound in the 18th century—The era of the calculus; 5. Sound in the 19th century—The science of sound; 6. Sound at the end of the 19th century—The theory of sound; 7. Sound at the beginning of the 20th century—The acoustical Society of America.

Natanson, Wladyslaw. Pierwsze Zasady mechaniki undulacyjnej. 76 p. Osobne odbicie z tomu XXXVII-go *Prac Matematyczno-Fizycznych*, zeszyt I, Warszawa, 1930. ISIS

History of undulatory physics (in Polish). G. S.

Rosenfeld, L. La première phase de l'évolution de la théorie des quanta. *Osiris* II, pt. 6, 149-96, 4 port., 1936. ISIS

See note under Physics.

Tandberg, J. Vad är 1 kilogram? En studie i metersystemet. *Elementär matematik, fysik och kemi* 17, 18 p., 3 fig., 1934. ISIS

Tandberg, J. Vad väger 1 kubikdecimeter vatten? En studie i metrologi. *Elementär matematik, fysik och kemi*, 16, 13 p., 5 fig., 1933. ISIS

Waller, I. Principes fondamentaux de la physique moderne. *Lychnos* 1, 272-78, 1936 (in Swedish, with French summary, p. 278). ISIS

" Les idées classiques ont été transformées par la théorie des quanta plus profondément que par la théorie de la relativité d'EINSTEIN, qui contient une revision de la notion du temps et de l'espace. L'analyse de HEISENBERG et surtout celle de BOHR ont démontré la possibilité seulement limitée de l'application des notions classiques, par exemple de la position et de la vitesse. Cela provient du fait que toute mesure est, selon la théorie des quanta, une intervention essentielle et incontrôlable du phénomène observé. Les progrès nouveaux de la physique théorique ont démontré que le développement dans les domaines nouveaux de l'expérience exige des notions et des lois fondamentales nouvelles."

25. — CHEMISTRY, PHYSICO-CHEMISTRY, INDUSTRIAL CHEMISTRY

Ferchl, Fritz; Süssenguth, A. Kurzgeschichte der Chemie. v + 217 p., 200 fig. Herausgegeben durch die Gesellschaft für Geschichte der Pharmacie, Mittenwald (Bayern), NEMAYER, 1936. ISIS

Brief history of chemistry down to the middle of last century. It includes a rich collection of illustrations (portraits, facsimiles, apparatus, laboratories). G. S.

Haynes, Williams. Chemistry's contribution. The economics of new materials. An address delivered before Princeton University on December 10, 1935, in the Cyrus Fogg Brackett lectureship in applied engineering and technology. 31 p. The Guild of Brackett Lecturers, 1936. ISIS

" Following is the story of how Chemistry is giving each one of us, better and cheaper, all sorts of things; from paints to perfumes; from noiseless gears to cigarette hölders; from new fabrics to new machines."

Kent, Andrew. On the early chemistry of gold. *Proceedings of the Royal philosophical society of Glasgow for the* 130th *session*, 1931-1932, 101-12, 1932. ISIS

Summary of a longer memoir submitted as a Ph. D. thesis in the University of Glasgow. This was, we believe, the first Ph. D. (science) awarded for historical research by an Scotch University. The author has examined the knowledge of gold chemistry at the disposal of western European alchemists. He concludes : " The technical equipment of the alchemical period was capable of invalidating any serious claim for successful transmutation of base metals, but numerous factors, especially the application of mineral acids of uncertain composition, probably led to ' augmentations ' in which even experts could not detect the added constituent, or to inexplicable residues of gold which had been unwittingly introduced by the operator himself. Fraudulent dexterity, false philosophy, public credulity and Royal rapacity all played their due part in the perpetuation of transmutation theory. It seems improbable, however, that these could have prevailed against the scepticism of practical metallurgists if the peculiar properties of gold had not offered serious difficulties to their standard technique, which possessed, in the early mineral acids, a new and fruitful source of suggestive misinterpretation." This is an original and valuable contribution to the history of alchemy. G. S.

Lieben, Fritz. Geschichte der physiologischen Chemie. x + 742 p. Leipzig, DEUTICKE, 1935. ISIS

Reviewed by EDUARD FÄRBER, *Isis* 25, 164-66, 1936.

Obermiller, Julius. Die Purpurfarbe im Sprachgebrauch. *Archiv f. Gesch. d. Math., d. Naturw. u. d. Techn.*, 13, 416-34, 1931. ISIS

" Über die Bedeutung des Begriffs ' Purpurfarben ' besteht eine überraschende Unstimmigkeit, und es erscheint nicht ohne Reiz, den Gründen hierfür einmal etwas näher nachzugehen."

Wilson, W. J. An alchemical manuscript of ARNALDUS DE BRUXELLA. *Osiris* II, pt. 8, 220-405, 4 ills., 1936. ISIS

See same note under XV-2.

26. — TECHNOLOGY

(*For mining, see* 32. *geology* ; *for industrial chemistry,* 25. *chemistry. See also arts and crafts under* 45)

Feldhaus, F. M. Die ältesten optischen Hilfsmittel ? *Der Sternfreund*, Nr. 1, p. 41, Berlin, 1936. ISIS

Eine Zusammenstellung der Funde geschliffener Linsen aus Troja, Kreta,

Babylon, Niniveh, Tyrus, Karthago, Nola, Pompeji und Wisby aus der Zeit von 2300 vor Chr. bis 550 nach Chr. Zunächst bleibt die Frage unbeantwortet, ob alle diese Stücke nur Zierate waren, oder ob man ihre optischen Eigenschaften, die bei der Bearbeitung und Benutzung nicht verborgen bleiben konnten, etwa als Brenngläser benutzte.

Feldhaus, F. M. Die Geschichte des Schlauches. Mit 10 Abbildungen. Einleitung der Jubiläums-Schrift der " Metallschlauch-Farbrik Witzenmann," Pforzheim, 1936. Der Schlauch als Tier-Balg. Der Schlauch als Rohr. Der Taucher-Schlauch bei ARISTOTELES. Die lange Schlauch-Leitung bei HERODOT (Buch 3, Kap. 9). Taucher-Schläuche im Mittelalter. Der Feuerwehr-Schlauch von 1672. Die Anfänge metallener Schläuche. ISIS

Feldhaus, F. M. Zur Geschichte der Brikett-Pressen. *Deutsche Betgwerkszeitung, Technische Blätter*, Nr. 17, 3 fig., Düsseldorf, 1936. ISIS

Akten der Saline Dürrenberg bei Halle und Akten der Technischen Deputation für Gewerbe in Preussen zeigen, wie die ersten Brikettpressen konstruiert waren, und zwar die Systeme Beyse-Milch, Schmahel und Exter. Das System Exter (1857) ist noch heute in der ganzen Welt in Benutzung.

Feldhaus, F. M. 33 Tafeln über Technik in " Deutscher Kultur-Atlas," hrsg. von MACKENSEN und LÜDTKE. 500 pl. (Format 35 mal 26 cm.). Berlin, DE GRUYTER. ISIS

Band 1 des Werks, das jetzt abgeschlossen wird, geht von der Prähistorie bis zum Jahr 1000. Der 2. Band geht bis 1517. Der 3. geht bis 1750. Der 4. geht bis 1870 und der letzte Band geht bis zur Gegenwart. Es werden alle Gebiete der deutschen Kultur behandelt. FELDHAUS bearbeitete Technik und Verkehr. Band 1 : Die Technik der Karolinger. Bd. 2 : Schiesspulver und Geschütz, Wehr und Waffen, Arbeit und Verkehr, Handwerk und 1 Tabelle der deutschen Erfindungen. Band 3 : Waffen, Verkehr, Der Geist der Technik, Kuriose Technik, Kraftmaschinen und 1 Tafel Erfindungen. Bd. 4 : Je 1 Tafel Waffen, Land-Verkehr, Wasser-Verkehr, Nachrichten-Verkehr, Luft-Fahrt, Bergbau, Kraftmaschinen, 2 Tafeln Manufakturen und 1 Tafel Erfindungen. Bd. 5 : 2 Tafeln Land-Verkehr, je 1 Tafel Wasser-Verkehr, Luft-Verkehr, Nachrichten-Verkehr, Waffen. Kraftmaschinen, Technik im Haus, Geschwindigkeiten und 1 Tafel Erfindungen.

Feldhaus, F. M. Die Wandlung des Teppichs von der Wand-Bekleidung zum Boden-Belag. figs. *Halbmond-Teppich-Zeitung*' Nr. 30, Ölsnitz i.v., 1936. ISIS

Man kennt die Entwicklung des Wand-Teppichs (Gobelins) recht gut, aber man weiss bisher wenig über die Geschichte der Teppiche, die man auf den Boden legt. Die Arbeit von FELDHAUS behandelt die Teppiche

mit vollkommen gefärbten Fäden. Die Geschichte der Teppiche mit stückweise gefärbten Fäden. Die Geschichte der Teppiche mit stückweise gefärbten Fäden (Druckteppiche) ist 1934 in einem Privat-Druck der Firma Gebrüder SCHOELLER, DÜREN, RHEINLAND, VON HASSLER behandelt, aber unzulänglich, denn H. L. SCHOELLER ist nicht der Erfinder der Druck-Teppiche. Er übernahm für Preussen das britische Patent von R. W. SIVIER (Nr. 13 467 und 13 650 von 1851). SCHOELLER reichte die englische Beschreibung des Verfahrens in Preussen 1851 zum Patent ein (Akten Staatsarchiv Berlin, Rep. 120, Techn. Dep., Akt. 579 und Schr. S. 22).

Feldhaus, F. M. Geschichte der Träger. 2 fig. Welt der Technik, Beilage zum " Deutschen Techniker," Nr. 9, Berlin, 1935. ISIS

Der metallene Balken (Träger) ist nicht erst 1824 von THOMAS TRETGOLD erfunden worden. Im Thermen-Museum zu Rom liegt ein grosser gewölbter bronzener Träger aus einem der Schiffe des Nemi-Sees, also aus der Zeit von Kaiser CALIGULA um 39 nach Chr. Bronzene Träger für die Saal-Decken hatten die Thermen des CARACALLA, die um 216 nach Chr. erbaut wurden. Die Vorhalle des Pantheons in Rom hatte seit 130 nach Chr. bronzene Träger in der Decke. Papst URBAN VIII. liess sie im Jahr 1632 herausbrechen und zu Geschützen umschmelzen. FAUSTO VERANZIO bildete in seinem 1616 erschienenen Buch " Machinae Novae " bronzene Träger für Decken und eine Brücke aus bronzenen Trägern ab (Tafel 49). Am 25. März 1824 legte TRETGOLD der " Royal Society " in London sein System eiserner Träger vor und seit diezer Zeit benutzte man sie vielfach im Bauwesen, besonders seitdem man zur 1. Welt-Ausstellung von 1851 den Cristal Palace bei London ganz aus Eisen—unter Verwendung von 2244 Trägern—errichtet hatte.

Forbes, R. J. 5000 Jaar Asphalt. *Chemisch Weekblad* 33, 264-67, 1936. ISIS

Gilfillan, S. C. The sociology of invention. xiii + 191 p. Chicago, FOLLETT, 1935. ISIS

Reviewed by ROBERT K. MERTON, *Isis* 25, 166-67, 1936.

Hough, Walter. Fire-making apparatus in the United States National Museum. *Proceedings of the United States National Museum* 73, 1-72, pls. 1-11, Washington, 1928. ISIS

Morgan, J. R. The search for a safety-lamp in mines. *Annals of science* 1, 302-29, 7 fig., 1936. ISIS

Robertson, J. Drummond. The evolution of clockwork. With a special section on the clocks of Japan. Together with a comprehensive bibliography of horology covering over 600 authors. xvi + 358 p., 101 ill. London, CASSELL, 1931 (21 s.). ISIS

Vauclain, Samuel M. What steam has meant to us. 19 p. The Newcomen society, American branch, 1936. ISIS

IV. — BIOLOGICAL SCIENCES (Knowledge of organic nature)

27. — BIOLOGY (*generalities, "natural history"*)

Himes, Norman E. The medical history of contraception. With a medical foreword by R. L. DICKINSON, M. D. xxxi + 521 p., 29 tbls. and 30 figs. in text. Baltimore, WILLIAMS and WILKINS, 1936. (Price $ 7.00). ISIS

This is a volume in the series on the *Medical aspects of human fertility* issued by the National Committee on Maternal health, Inc. It is an elaborate survey of the subject in all of its aspects from classic times to the present. It traces its evolution in preliterate societies before the dawn of written history; among Egyptians, Hebrews, Greek and Roman writers; in Eastern cultures of Japan, China, and India; in the Islamic world and Europe in the Middle Ages; and presents its democratization since 1800 in Europe and the United States. Summaries are given of the 19th and 20th century writings on the subject. Closing chapters deal with clinical and social results. The author "softpedals" the latter, criticizing the "assumptions" of DUBLIN and other statisticians. The problem is vastly greater than a clinical one involving the relative intelligence of classes in mixed populations, the future of civilization, and the fate of nations—witness the attitude of MUSSOLINI and the recent action of the U.S.S.R. on abortion. It is a scholarly work worthy of the importance of the subject. There is a bibliography of 66 pages and an excellent index. C. A. K.

Hofsten, N. von. Ideas of creation and spontaneous generation prior to DARWIN. *Isis* 25, 80-94, 1936. ISIS

Keudel, Karl. Zur Geschichte und Kritik der Grundbegriffe der Vererbungslehre. *Archiv f. Gesch. d. Med.*, 28, 381-416, 1936. ISIS

Pearl, Raymond. Biology and human trends. *Journal of the Washington Academy of sciences* 25, 253-72, 1935. ISIS

Pearl, Raymond. Human biology in schools and colleges. *School and society* 42, 16 p., 1935. ISIS

Woodruff, Lorande Loss. Foundations of biology. Fifth edition. xiv + 583 p., 377 fig., New York, MACMILLAN, 1936 ($ 3.50). ISIS

Excellent textbook, admirably comprehensive, eclectic and wise. Contents : 1. The scope of biology; 2. Cellular organization of life; 3. The physical basis of life; 4. Metabolism of organisms; 5. The multicellular organism; 6. The plant body; 7. Reproduction in plants; 8. The animal body : invertebrate; 9. The animal body : vertebrate; 10. Nutrition; 11. Respiration; 12. Circulation; 13. Excretion; 14. Reproduction; 15. Coördination; 16. Origin of life; 17. The continuity of life; 18. Fertilization; 19. Development; 20. Inheritance; 21. Organic adaptation; 22. Origin of species; 23. Biology and human welfare; 24. Biological history; 25. Review of the plant kingdom; 26. Review of the animal kingdom. Appendix 1. Classification; 2. Bibliography; 3. Glossary; Index. It will be noticed that a chapter (32 p.) is devoted to the history of biology. G. S.

Zirkle, Conway. Animals impregnated by the wind. *Isis* 25, 95-130, 1936. ISIS

" Four types of females were the chief recipients of the winds' attentions; they were mares, vultures, hens and women. This makes it possible for us to arrange the stories into four classes, each concerned with one of the four subjects. Surprisingly enough, when the stories are thus grouped they do not seem to be mere variants of some one primitive legend, but rather four separate tales, each with its own origin but each influenced by the others in the course of its development. The reason why the wind was chosen as the fecundating agent in all four cases is not at all clear. It will probably have to be sought in some psychological twist of the not quite civilized folk among whom the stories originated."

28. — BOTANY

(*Agronomy, phytopathology, palaeobotany*)

Castetter, Edward F. Uncultivated native plants used as sources of food. 62 p. The University of New Mexico Bulletin, *Ethnobiological studies in the American Southwest*, 1, 1935. ISIS

Chronica botanica. Edited by Fr. VERDOORN in collaboration with an advisory board and numerous assistant and corresponding editors. Vol. 2, 479 p., numerous portraits and illustrations. Leiden, Holland, Chronica Botanica, Ltd. 1936 (15 guilders). ISIS

This very well edited and widely useful chronicle contains a calendar of events and anniversaries of births and deaths of plant scientists; illustrated reports of all sorts of plant congresses, societies, conferences, and associations; an annual review of activities, personnel changes, names of directors and addresses of all botanical organizations engaged in education, research, or its applications, dealing in any manner with plants throughout the world from Alaska to Zanzibar; discussions, announcements, queries, and requests of botanical interest; a list of 67 new periodicals of botanical content; 28 pages of new or changed addresses of botanists; a valuable series of advertisements

of botanical publications; and indices of places and persons. This compendium of the current status of botanical institutions and current investigational enterprises of their staffs constitues an indispensable source book for the future historian of the botanical sciences. It is edited with skill, comprehension, and vision, and illuminated with snapshots and genre sketches. Either the editor or the printer's devil evidently has a keen sense of humor.
C. A. K.

Johnson, Helen M. The lemon in India. *Journal of the American oriental society* 56, 47-50, 1936. ISIS

" In the article ' The lemon in China and elsewhere " the late Dr. LAUFER started with two assumptions : that the lemon is among the ' fruits we owe to India '; and that ' the word type *lemon* is of Indic origin.' Both of these assumptions are contrary to the generally expressed theories of botanists and philologists; and Dr. LAUFER gave no evidence in favor of them. The one botanist, Sir GEORGE WATT, whom he quotes to support his views, is misquoted; his statements are the opposite of those attributed to him by Dr. LAUFER. The reason, perhaps, for this misquotation is that throughout his article Dr. LAUFER apparently uses the word ' lemon ' for *Citrus medica, var. acida* (WATT), which is the sour or common lime of India. That is, he transfers the Sanskrit and vernacular names of the lime to the lemon."

Marzell, Heinrich. Der Zauber der Heilkräuter in der Antike und Neuzeit. *Archiv für Geschichte der Medizin* 29, 3-26, 1936.

Potter, Alfred C. Some early books on tobacco. A paper read before the Club of odd volumes in Boston, April 10, 1910, with some omissions and a few additions. *Harvard library notes* 3, 101-18, 1936. ISIS

Shear, C. L. Uniformity and stability of mycological nomenclature. *Mycologia* 28, 337-46, 1936. ISIS

Showing that historical investigations are essential for the stabilization of generic and specific names. G. S.

Shreve, Forrest. The plant life of the Sonoran desert. Carnegie Institution of Washington, supplementary publications, no. 22, 19 p., figs., 1936. ISIS

Lecture delivered at the Administration building of the Carnegie Institution of Washington, December 3, 1935.

Sigerist, Henry E. Herba momordica. *Bulletin of the institute of the history of medicine* 4, 511-13, 1936. ISIS

" There can be no doubt that the *herba momordica sive caranza* of the

Montpellier manuscript is not madder but the *viticella* or *balsamina* of MATTIOLI, which in modern nomenclature is *Momordica Balsamina* (LINNÉ)."

29. — ZOOLOGY

Allen, F. P. A check list of periodical literature and publications of learned societies of interest to zoologists in the University of Michigan libraries. 83 p. (Museum of zoology, University of Michigan, circular no. 2). Ann Arbor, University of Michigan Press, 1935. ISIS

Contains about 1300 items.

Bodenheimer, F. S. Über die Ausstellung alter zoologischer illustrierter Werke während des XI. Zoologenkongresses in Padua (September 1930). Mit besonderer Berücksichtigung der Entomologie-Geschichte. *Archiv f. Gesch. d. Math., d. Naturw. u. d. Techn.*, 13, 473-75, 1931. ISIS

Bodenheimer, F. S. Zur Frühgeschichte der Erforschung des Insektenparasitismus. *Archiv f. Gesch. d. Math., d. Naturw. u. d. Techn.* 13, 402-16, 1931. ISIS

Essig, E. O. A sketch history of entomology. *Osiris* 2, part 4, 80-123, 1936. ISIS

Contents : Introduction; Eras; Ancient entomology; Middle Ages; The minute anatomists; Systematic entomology; Insect collections; Insect surveys; Monographs; Catalogues; Societies; Entomological museums; Teachers; Artists; Evolution; Mimicry; Insect phylogeny; Paleoentomology; Insect embryology; Economic entomology; Medical entomology; Other fields; Selected bibliography.

Gudger, E. W. The earliest published figures (1613-1758) of the oblong or truncate tailed ocean sunfish, *Ranzania truncata*. *Nature* 137, 947, 1 fig., 1936. ISIS

Neviani, Antonio (S. O.). Appunti per una storia intorno ai foraminiferi dall'antichità al secolo XVIII. Con appendice sugli antichi microscopi dell'Istituto di Bologna venduti all'esterno nel 1886. *Memoriae Pont. Academiae scientiarum Novi Lyncaei*, series III, vol. II, 131-210. Ex aedibus Academicis in Civitate Vaticana, 1936. ISIS

" Investigat Auctor in studia primitus habita de foraminiferis a STRABONIS tempore usque ad saeculum XVIII et enumerat nomina sapientium et opus quod ad hunc finem pro singulis navatum fuit."

Parte I. Le pietre frumentarie, lenticolari e simili. 1. ERODOTO, STRABONE e PLINIO; 2. ULISSE ALDROVANDI, MICHELE MERCATI e FERRANTE IMPERATO; 3. Gravi equivoci su primitive denominazioni. Il P. ATANASIO KIRCHER e NICOLA LANG; 4. Altre false denominazioni; 5. JAN. JAC. SCHEUCHZER, L. FERD. MARSILI e LUD. BOURGUET; 6. Da ANT. VALLISNERI alla fine del settecento; 7. ALFR. FORTIS e GIAN BATTA BROCCHI.

Parte II. I minuti foraminiferi da ALDROVANDI ai tempi di GIOV. BIANCHI; 8. ULISSE ALDROVANDI, ROB. HOOKE ed. ANT. LEEUWENHOEK; 9. GIAN. BARTOL. BECCARI; 10. GIOV. BIANCHI (JANO PLANCO) e CARLO ALLIONI; 11. PIER ANT. MICHELI; 12. NICOLA GUALTIERI; 13. J. PHIL. BREYN e FREDR. HOFFMANN; 14. FERD. BASSI e GIUS. GINANNI; 15. L'ab. ROCCO BOVI e l'ab. FEL. FONTANA; 16. LUIGI FERDINANDO MARSILI; Riepilogo; Bibliografia.

Oppenheimer, Jane M. Historical introduction to the study of teleostean development. *Osiris* 2, pt. 5, 124-48, 6 pl., 1936. ISIS

Schenk, Edward T.; McMasters, John H. Procedure in taxonomy, vii + 72 p. Stanford University Press, Cal., 1936 ($ 2.00). ISIS

This volume, which includes a reprint of the invaluable exhaustive International rules of zoological nomenclature together with the summaries of opinions rendered up to the present date on taxonomic matters in so far as they relate to the animal kingdom, represents the result of two symposia composed of graduate students and professors held at Stanford University in the years 1932 and 1934-35. The organization of the material here brought together was largely the work of those participating in the symposia. Messrs. SCHENK and MCMASTERS being responsible for its final presentation. The authors modestly claim to afford no more than some aid to the systematist in overcoming some of the difficulties encountered in his work, especially in the description of new species. Systematic categories, Types, The description of a new species, Specific names, Synonymy, Storage of type material, are the subjects which are specifically dealt with. A final chapter deals with the uses of Latin terms and abbreviations; all this being achieved within the narrow space of twenty-five pages! The remaining pages are devoted to the International rules and the Opinions. Supplying as it does a most urgent need, this book is bound to become an indispensable part of the equipment of anyone who is in any way concerned with animal systematics. The definitions are models of brevity and clearness, and the illustrative examples are as succinct. Into the *ad hoc* taxonomical confusion of the past which has lingered into our own day this book will serve to introduce a much needed order. Hereafter there can be no excuse for clumsy taxonomics and barbarous neonyms. The present volume would be an excellent text for use by all classes of students of the animal kingdom. Useful references to the relevant literature are provided and there is an excellent index. Messrs. SCHENK and MCMASTERS are to be congratulated upon a most excellent and useful contribution to systematics. M.F.A.-M.

V. — SCIENCES OF THE EARTH

(implying knowledge of both organic and inorganic nature)

31. — GEOGRAPHY AND OCEANOGRAPHY

Aagaard, Bjarne. Fangst og Forskning i Sydishavet. Tredje Bind. Antarktikas historie. Vol. 1, 554 + lii p. Oslo, GYLDENDAL, 1934. ISIS

Reviewed by R. N. R. BROWN, *Geographical journal*, 86, 370-71, 1935. "A thorough record of all ships which went within sight of the southern ice up till 1840." C. W. A.

Beaglehole, J. C. The exploration of the Pacific. xv + 411 p., 4 maps. London, BLACK, 1934 ($ 5.00). ISIS

This is the first volume of the newly launched series of "Pioneer histories" under the editorship of V. T. HARLOW, lecturer in colonial history at the University of Oxford, and J. A. WILLIAMSON, author of *Voyages of the Cabots*, etc.; the series is designed to provide accounts of the several movements that have shaped the course of European expansion. This, its first volume, has a particular value in the history of science since it concerns an area least embroiled in war and least remunerative in commerce, but it is of most interest to the various sciences, because the expeditions exploring the Pacific generally reported on matters of scientific import in the biological sciences, anthropology and related subjects. Geography is not a matter of discovery alone. The author deals analytically with the underlying motive of much of the voyaging to the South Seas, namely, the search for the long-imagined *Terra Australis Incognita*, which search culminated in European settlement of Australasia. The book includes an account of the exploration of the Pacific from MAGELLAN to COOK, omits the shores of the mainland, and confines its scope to Australasia and the major island groups of the great ocean. Especial attention is paid to the voyages of MAGELLAN, MENDAÑA, TASMAN, DAMPIER, ROGGEVEEN, BYRON, WALLIS, BOUGAINVILLE, and COOK. His assessment of the scientific importance of COOK's three voyages is critical and significant. COOK changed the philosophy of geography from enlargement of empire to the "neutral and unslaked intent of science." He raised navigation from the shuttlecock of circumstance to the status of science. His scientific foresight, his infinite care for the details of equipment of the vessels in his charge and the health and welfare of his men, saved his voyages of eleven years duration from all but his own tragic fate. C. A. K.

Bernacchi, L. C. Antarctic exploration past and present. *Geography* 20, 176-90, 1935. ISIS

Historical outline in first nine pages. C. W. A.

Chabanier, E. Connaissance de la Mer Rouge. *La géographie* 65, 85-124, 1936. ISIS

Étude historique fort riche. I. Conditions générales d'une tentative militaire contre la voie de terre—RENAUD DE CHATILLON; II. La recherche de l'encens; III. Les difficultés de retour révélées par le voyage de JOHAM DE CASTRO; Conclusion. G. S.

Fontoura da Costa, A. A Marinharia dos descobrimentos. Bibliografia náutica portuguesa, até 1700. Separata dos " Anais do Club Militar Naval." 512 + x p. Lisboa, Impressa da Armada, 1933. ISIS

Reviewed by E. H. G. DOBBY, *Geographical journal* 86, 374-76, 1935. ' Taking each basic process of navigation, the author traces its development as exhibited in the sources under examination." C. W. A.

Lehmann, Edgar. Alte Deutsche Landkarten. 52 p. Leipzig, Bibliographisches Institut, 1935. ISIS

Reviewed by E. G. R. TAYLOR, *Geographical journal* 86, 541, 1935. " A well-balanced account of progress of cartography in Germanic lands during 16th and 17th centuries." C. W. A.

Sykes, Sir Percy. A history of exploration from the earliest times to the present day. xiv + 374 p., colored frontispiece, 24 pls., 35 maps. New York, MACMILLAN, 1934 ($ 7.00). ISIS

This is an authoritative, comprehensive, and critical survey of significant efforts in the exploration of the earth's surface from the time of the Sumerians to the latest Antarctic expedition. The task is a large one involving a perspective of relative values and relative attractiveness to the general reader, for whose information the book is written. The author's long acquaintance with and interest in exploration peculiarly fit him for the selection and presentation of this historical outline of one of man's great adventures. He emphasizes the less known and more remote regions because of their interest and deals in a comprehensive manner with the opening up of the great continental regions such as Australia, Siberia, Japan, Tibet, Arabia, and the territories of the Nile and the Niger. He describes the ancient centers of civilization in the Levant; ALEXANDER THE GREAT; the explorers from the Chinese, Roman, and Moslem Empires; the Vikings and Crusaders; MARCO POLO and IBN BATTUTA; the Circumnavigators and Conquistadors; Captain COOK; the opening of the Americas; LIVINGSTONE; and the explorers of the polar regions. C. A. K.

32. — GEOLOGY, MINERALOGY, PALAEONTOLOGY, MINING

(*For palaeobotany, palaeozoology and palaeoanthropology, see respectively* 28. *botany*, 29. *zoology and* 39. *prehistory*)

Geiler, Heinz. Zur Geschichte der geothermischen Tiefenstufe. *Archiv f. Gesch. d. Math., d. Naturw. u. d. Techn.* 13, 352-58, 1931. ISIS

Högbom, A. G. The Petridelaunic flood. A study on account of a centenary. *Lychnos* 1, 1-70, 14 fig., 1936 (in Swedish, with English summary, pp. 71-5). ISIS

" The main subject of the present treatise are the theories of catastrophic deluges, maintained by several naturalists in the first half of the 19th century; further, an account is given of later changes of these theories until the present interpretation by glaciations and extended land-ices; and, at last, follows a short review of the earlier speculations and theories from which the theories of catastrophic floods have developed and through which they are connected with the biblical story of the Deluge and the still older Gilgamesch Epos."

33. — METEOROLOGY, CLIMATOLOGY AND TERRESTRIAL PHYSICS

Clark, J. Edmund. The history of British phenology. *Quarterly journal of the meteorological society* 62, 19-23, 1936. ISIS

VI. — ANTHROPOLOGICAL AND HISTORICAL SCIENCES

(Knowledge of man, past and present)

34. — ANATOMY

Ariëns, Kappers C. U.; Huber, G. Carl; Crosby, Elizabeth Caroline. The comparative anatomy of the nervous system of vertebrates. Vol. 1, xvii + 864 p., vol. 2, xi + 981 p., 710 fig. New York, MACMILLAN Co., 1936 ($ 16.00). ISIS

This book is an outgrowth of *Die vergleichende Anatomie des Nervensystems* by Prof. ARIËNS KAPPERS, it is, however, not a translation of that book but a completely new work which had its origins in the attempt to present a new version of Professor ARIËNS KAPPERS famous book. The collaborators (Professor HUBER unhappily died before the publication of the work) have treated in these two large volumes of the comparative anatomy of every portion of the vertebrate nervous system from amphioxus to man. Each chapter gives an account of practically everything that has been written on the subject

with which it deals, and is followed by an exhaustive bibliography, thus whilst providing a connected account of the whole subject the book at once assumes the place of the most authoritative reference work on the vertebrate nervous system in existence. Indeed, the whole work is encyclopaedic. There are 130 three-column pages of indices. The book is extremely well produced and servicably bound in heavy buckram. Both authors and publishers are to be congratulated upon bringing this invaluable work to a conclusion. M. F. A.-M.

Richter, Gottfried. Das anatomische Theater. 156 p. (Abhandlungen zur Geschichte der Medizin und der Naturwissenschaften, 16). Berlin, EBERING, 1936. ISIS

35. — PHYSICAL ANTHROPOLOGY

(*Anthropometry and races of man*)

Barreiro, Agustin Jesús. El origen de la raza indígena de las islas carolinas. 131 p. Madrid, Imprenta del asilo de huérfanos del S. C. de Jesús, 1920. ISIS

Trabajo presentado en el Congreso de las ciencias de Sevilla celebrado durante los dias 6 a 11 de Mayo de 1917.

Howard, Edgar B. Early man in America. *Proceedings of the American philosophical society* 76, 327-33, 1936. ISIS

Ploss, Hermann Heinrich ; Bartels, Max ; Bartels, Paul. Woman. An historical gynaecological compendium. Edited by ERIC JOHN DINGWALL. 3 volumes, 1. xiii + 655 p. ; 2, 820 p. ; 3, 543 p., 1002 ills., 7 pl. London, HEINEMANN, 1935. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 25, 167-69, 1936.

37. — PSYCHOLOGY (*human and comparative*)

Deonna, Waldemar. De la planète Mars en Terre sainte. Art et subconscient. Un médium peintre, HÉLÈNE SMITH. 408 p., ill. Paris, BOCCARD, 1932. ISIS

Apropos des peintures religieuses faites en transe somnambulique par le fameux médium, M^lle^ ELISE CATHERINE MULLER (morte à Genève 1929), jadis étudiée sous le nom d'HÉLÈNE SMITH par THÉODORE FLOURNOY : Des Indes à la planète Mars (1900), Nouvelles observations sur un cas de somnambulisme avec glossolalie (*Archives de psychologie*, vol. 1, 1901). G. S.

Müller-Freienfels, Richard. The evolution of modern psychology. Translated from the German by W. BÉRAN WOLFE. xvi + 513 p. New Haven, Yale University Press, 1935. ($ 5.00). ISIS

This is a critical and succint survey of all fields of this youngest of the biological sciences, published by the Yale University Press with the aid of the Mather Foundation. The author's work is characterized by wide perspective, encyclopedic knowledge, broad understanding, and keen intuition. It is especially significant in evaluating the several schools of psychological thought and tracing their growth in their historical succession. The author leaves the reader with a vivid awareness of the incompletenesses of this juvenile science but also with a sense of its virility. In the introductory chapter one finds discussions of the psychology of primitive man, of ancient India and Greece, of the Mediaeval period and the Renaissance, and of recent centuries, reconstructed after the manner of the palaeontologist, in the light of later and fuller knowledge of the framework of thought and emotion. The closing sections seek to interpret parapsychological fields. A selected and classified bibliography and indices of names and subjects add to the usefulness of this scholarly work of historical orientation much needed in this seemingly quite disjunct field of science. C. A. K.

38. — ARCHAEOLOGY (*generalities, methods*)

HISTORY OF ARCHAEOLOGY AND ERUDITION

Deonna, W. Qu'est-ce que l'archéologie? *Scientia*, 16, 3-20, 1914. ISIS

Forbes, R. J. Archaeologie en Exacte Wetenschappen. Lecture read before the VIIIth Congress of the Ostersch Genootschap in Nederland, 7-12. 6-8 January 1936. ISIS

39. — PREHISTORY

Carénou, Charles. La religion dolménique, suivie du déchiffrement de la pierre du dolmen ruiné de parc guren. 92 p., 25 fig. Paris, GEUTHNER, 1935 (20 fr.). ISIS

Collum, Vera Christina C. The re-excavation of the Déhus chambered mound, at Paradis, Vale, Guernsey. Undertaken for the States of Guernsey by Sir ROBERT MOND, LL. D., F.S.A., and carried out on his behalf in September-October 1932. Together with studies of the pottery and human remains recovered in this and the earlier excavations and an investigation of the cult responsible for megalithic burials and for the symbols found in these tombs. 189 p. La Société Guernesiaise, 1933 (2/6). ISIS

Feldhaus, F. M. Aus den Anfängen keramischer Formgebung. 4 fig. *Keramische Rundschau*, Nr. 1, p. 6, Berlin, 1935. ISIS

Nach der Theorie des rumänischen Professors NETOLITZKY bildete man die ersten Gefässe aus Ton den Gefässen aus Tier-Blasen nach. So erklären sich die Formen von Kugel-Amphoren und Stand-Gefässen aus Ton, die genau dieselben Formen haben, wie Tierblasen-Gefässe, die man mit Sand füllte und dann trocknete.

Martin, Cecil P. Prehistoric man in Ireland. xi + 184 p. New York, MACMILLAN, 1935. ($7.50). ISIS

Dr. CECIL MARTIN's account of prehistoric man in Ireland has been carried out in the orthodox manner fashionable during the latter quarter of the last century, which means that his book is both interesting and readable, and that it provides a valuable and fairly exhaustive account of the prehistoric crania of Ireland as well as of their provenance, whenever it has been possible to determine the latter. The work shows much devoted labour, is well illustrated, and contains seventeen tables of cranial measurements and indices. Statistical analyses of the data are lacking, but since the necessary data are given in the tables, the anthropologist will be able to make the desired analyses for himself. The book appears to have been written with an eye to the requirements of the general reader, and until the reports of the Harvard Anthropological Survey of Ireland become available, and even after the appearance of the latter, it may efficiently serve as an introduction to a subject upon which the most learned of us are fairly completely ignorant. There is a good bibliography and an index. M. F. ASHLEY-MONTAGU.

Roberts, Frank H. H., jr. Additional information on the Folsom complex. Report on the second season's investigations at the Lindenmeier site in Northern Colorado. 38 p., 12 pl. (*Smithsonian miscellaneous collections*, 95, no. 10). Washington, D. C., 1936. ISIS

Viollier, D. Moules de fondeurs de l'âge du bronze au musée de Genève. *Genava*, vol. 4, 83-90, 2 fig., 1926. ISIS

40. — ETHNOLOGY

(*Primitive and popular science*)

Castetter, Edward F.; **Underhill, Ruth M.** The ethnobiology of the Papago Indians. 84 p. *The University of New Mexico Bulletin, Ethnobiological studies in the American Southwest*, 11, 1935. ISIS

Fortune, Reo Franklin. Manus religion. ix + 391 p. (*Mémoirs*

of the American philosophical society 3, 1935). University of Pennsylvania Press, Philadelphia. ($ 3.00). ISIS

Dr. REO FORTUNE in the present work makes available the first thoroughgoing account of the religion of the Manus tribe of the Admiralty Islands. Certain aspects of the social organization of this tribe have recently been treated by Dr. MARGARET MEAD in a number of interesting studies, and Dr. FORTUNE promises us further accounts of the economics and the language of this tribe. Of the present work it need here only be said that it represents a first rate account, based upon intensive field work, of all that is embraced in the operational scheme of Manus religion. The memoir is illustrated with ten excellent plates, and there is a good index.

M. F. A.-M.

Garboe, Axel. The angle-worm. A detail study in popular medicine. *Janus* 40, 43-48, 1936. ISIS

Herzog, George. Research in primitive and folk music in the United States. iv + 97 p. *American Council of learned societies*, bulletin no. 24, 1936. ISIS

Railliet, G. Médecine populaire (Glanes d'un practicien rémois). *Bulletin de la société française d'histoire de la médecine* 31, 98-116, 161-76, 1936. ISIS

Sarton, George. Sator arepo formula. *Answer*, no. 52. *Isis* 25, 134, 1936. ISIS

Thompson, Stith. Motif-index of folk-literature. A classification of narrative elements in folk-tales, ballads, myths, fables, medieval romance, exempla, fabliaux, jestbooks, and local legends. Volume 5, L-Z, 485 p. (*Indiana University studies* 22, nos. 108, 109, 110). Bloomington, Ind., 1935. ISIS

Classification L., Reversal of fortune; M., Ordaining the future; N., Chance and fate; P., Society; Q., Rewards and punishments; R., Captives and fugitives; S., Unnatural cruelty; S., Sex; U., The nature of life; V., Religion; W., Traits of character; X., Humor; Z., Miscellaneous groups of motifs; Additions and corrections. The previous volumes have been analyzed in *Isis*. The sixth and concluding volume (an alphabetical index) will appear within the year. M. C. W.

Ünver, A. Süheyl. Le folklore dermatologique en Turquie. Copia ex II° volumine deliberationum IX-1 Congressus internationalis dermatologorum, 6 p. Deri hasta liklari ve frengi kliniği arşivi, no. 11-12, Istanbul 1935 (in Turkish and French). ISIS

Wright, Jonathan. The medicine of primitive man—XXVI. *Medical life* 43, 144-52, 1936. ISIS

43. — SOCIOLOGY, JURISPRUDENCE AND POSITIVE POLITY

Westermark, Edward. The future of marriage in western civilization. xiv + 281 p. New-York, MACMILLAN, 1936 ($ 2,50). ISIS

In this extremely interesting book, which may be regarded as supplementary to the author's *History of marriage*, Professor WESTERMARCK deals with the various aspects of marriage as they exist to-day, and by examining the various problems that have arisen in connection with this institution in our own time, attempts to find an answer to the question whether marriage in its present form and the laws and customs relating to it are likely to survive or to undergo a change. His discussion of these matters is both sound and humane, and it is pleasant to be able to record that Professor WESTERMARCK is on the whole optimistic. M. F. A.-M.

44. — HISTORY OF CIVILIZATION

(*General history, historical methods, biography and chronology*)

Jaryc, Marc. La " Bibliographie internationale des sciences historiques." Revue du livre et des bibliothèques, 9 pages, 1936. ISIS

Lovejoy, Arthur O.; Boas, George. A documentary history of primitivism and related ideas. Volume I : Primitivism and related ideas in antiquity. With supplementary essays by W. F. ALBRIGHT and P. E. DUMONT. xv + 482 p. (Contributions to the history of primitivism). Baltimore, Johns Hopkins Press, 1935. ISIS

Reviewed by GEORGE SARTON, *Isis* 25, 169-72, 1936.

Rose, J. Holland. Man and the sea. Stages in maritime and human progress. xi + 288 p., 28 pl., 2 maps, 28 figs. Boston, HOUGHTON MIFFLIN, 1936 ($ 3.00). ISIS

The author is the professor of naval history in Cambridge University. The book is a selection of topics illustrative of great achievements in man's conquest of the sea. ODYSSEUS and DAMPIER are chosen as figures typical of man's eager search into the unknown which quickened primitive and eighteenth century inquiries into the ways of distant peoples and of nature in other climes. The limitations imposed on navigation by the use of oars enter into the historical question as to the extent of Phoenician explorations

of the African coast. The effects of non-seafaring habits of the Hebrews are compared with the nautical achievements of the later Romans and the Vikings, whose one-master boats were succeeded by the three-masters of the Columbian age. These made Spain, for a time, the mistress of the seas, only to give way to the seamanship of the Dutch and the British. Captain Cook's exploits in the South Seas were made possible by his unwittingly hitting upon the use of essential vitamin-containing foods in the stores of sailing ships. The author analyses the significance of sea power versus land power in the outcome of the Napoleonic era and the effect of steam power on the suppression of the slave trade. C. A. K.

Sarton, George. The unity and diversity of the Mediterranean world. *Osiris* II, pt. 9, 406-63, 1936. ISIS

This is the first of eight Hitchcock lectures delivered in California in 1933. It deals with the foundations of European culture. G. S.

49. — HISTORY OF RELIGION (*Science and religion*)

Boodin, John Elof. God. A cosmic philosophy of religion. 240 p., port. New York, Macmillan, 1934. ($ 2.00). ISIS

This book in conjunction with the author's *Cosmic evolution* (1925) presents a poet-philosopher's epic—an idealistic world view in line with the progress of history and science. In attempting this reinterpretation the Platonic tradition was found to be congenial. The author rejects chance in favor of cosmic control or cosmic structure, assumes the doctrine of evolution or orderly continuity along multiple lines or integration, and regards emergence as merely descriptive. He advocates a theory of creation through interaction under cosmic control. " The wholeness of the organism is made possible by the interaction of the parts under the guidance of the dominant control." God is conceived as transcendent and immanent and beauty is his attribute. C. A. K.

Russell, Bertrand. Religion and science. 256 p. London, Butterworth, 1935. ISIS

VII. — MEDICINE

50. — HISTORY, ORGANIZATION AND PHILOSOPHY OF MEDICINE

Aschoff, L.; Diepgen, P. Kurze Übersichtstabelle zur Geschichte der Medizin. Dritte völlig umgearbeitete Auflage. v + 61 p. München, Bergmann, 1936. ISIS

A revised edition of a brief but comprehensive outline of the history of medicine with the following main divisions : A. Primitive medizin. B. Heilkunde der antiken Kulturvölker. C. Das Mittelalter. D. Neue Zeit. E. Grundzüge der jüngsten Entwicklung der Heilkunde. M. C. W.

Camelin, J. La compagnie du Saint-Sacrement de Lyon et les médecins. *Bulletin de la société française d'histoire de la médecine* 31, 85-97, 1936. ISIS

Clark, Paul F.; Clark, Alice Schiedt. Memorable days in medicine. A calendar, April-May-June-July. *Medical life* 43, 123-43, 223-66, 1936. ISIS

Deonna, Waldemar. Emblèmes médicaux des temps modernes. Du bâton serpentaire d'ASKLÉPIOS au caducée d'HERMÈS. *Revue internationale de la Croix rouge*, 15e année, nos. 170-72. 80 p. Genève, 1933. ISIS

Diepgen, Dr. Les influences religieuses sur le développement de la médecine. *Bull. de la société franç. d'hist. de la méd.*, 32, 136-44, 1936. ISIS

Friedenwald, Julius; Morrison, Samuel. The history of the development of the stomach tube with some notes on the duodenal tube. *Bulletin of the institute of the history of medicine* 4, 425-54, 5 fig., 1936. ISIS

Hume, Edgar Erskine. Early Kentucky medical literature. *Annals of medical history* 8, 324-47, 5 fig., 1936. ISIS

Oliver, John Rathbone. Spontaneous combustion—a literary curiosity. *Bulletin of the institute of the history of medicine* 4, 559-72, 4 fig., 1936. ISIS

Sigerist, Henry E. The medical student and the social problems confronting medicine today. *Bulletin of the institute of the history of medicine* 4, 411-22, 1936. ISIS

Thoms, Herbert. Classical contributions to obstetrics and gynecology. With a foreword by HOWARD A. KELLEY. xxiii + 265 p., ill. Springfield, Ill., THOMAS, 1935. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 25, 174-75, 1936.

Thorndike, Lynn. Little known names of medical men in Vatican Palatine manuscripts. *Annals of medical history* 8, 145-59, 1936. ISIS

Thorndike, Lynn. Unfamiliar medical works by known and anonymous authors in Vatican Palatine Latin MSS. *Annals of medical history* 8, 297-305, 1936. ISIS

Tricot-Royer, Dr. L'Eglise et la mutilation du cadavre humain, décarnisation—dissection pour enseignement, embaument—autopsie. *Revue médicale de Louvain*, no. 23, 1935 ; no. 3, 4, 6, 16 p., 1936. ISIS

Ünver, A. Süheyl. Les bases de la médecine chez les Turcs Ouigours. Türk tib cemiyeti mecmuasi yil 1, (78), no. 10, Istanbul, 1935. (In Turkish and French). ISIS

Van der Kley, J. J. De Polen en de geneeskunde. *Bijdragen tot de geschiedenis der geneeskunde* 16, 55-56, 1936. ISIS
On Polish medicine.

Whipple, Allen O. Rôle of the Nestorians as the connecting link between Greek and Arabic medicine. *Annals of medical history* 8, 313-23, 4 fig., 2 maps, 1936. ISIS

51. — EPIDEMIOLOGY, HISTORY OF SPECIAL DISEASES PUBLIC HEALTH AND SOCIAL MEDICINE

Chaumartin, Henry. Le feu Saint ANTOINE et le mal des ardents. Etude historique, médicale, hagiographique et légendaire. *La médecine internationale illustrée*, 43e année, 309-18, 341-50, 373-81, Paris, 1935 ; 44e année, 21-8, 57-63, 87-95, 120-26, 152-58, 1936 (à suivre).

Futcher, Palmer Howard. Notes on insect contagion. *Bulletin of the institute of the history of medicine* 4, 536-58, 1936. ISIS

Klauder, Joseph V. Syphilis and the characters in IBSEN's dramas. *Annals of medical history* 8, 236-41, 1936. ISIS

Krumbhaar, E. B. A pre-Columbian Peruvian Tibia exhibiting syphilitic(?) periostitis. With recognizable varieties of bone marrow cells. *Annals of medical history* 8, 232-35, 4 fig., 1936. ISIS

Nafiz, M. F. Die Cholera-Epidemie zu Konstantinopel und Verhaltungsmassregeln dabei. Türk tib tarihi arkivi. Vol. I. Istanbul, 145-56, 1935 (in Turkish with German summary). ISIS

Ponzi, E. Una documentazione trascurata nella storia del taglio cesareo. *Rivista di storia delle scienze mediche* 27, 103-10, 3 fig., 1936. ISIS

Ünver, A. Süheyl. Aperçu sur les dermatoses chez les Ouigours. Deri hasta liklari ve frengi kliniği arşivi, no. 11-12, 4 p., Istanbul, 1935 (in Turkish and French). ISIS

Ünver, A. Süheyl. Sur l'histoire de la peste en Turquie. Tedavi Kliniği ve laboratuvari 5, 19 p. Istanbul, 1935 (in Turkish and French). ISIS

52. — HISTORY OF HOSPITALS, OF MEDICAL TEACHING AND OF THE MEDICAL PROFESSION BALNEOLOGY, MEDICAL GEOGRAPHY

Rolleston, Sir Humphry. The personalities of the Oxford medical school from 1700 to 1880. *Annals of medical history* 8, 277-87, 5 fig., 1936. ISIS

Shafer, Henry Burnell. The American medical profession, 1783 to 1850. 271 p. Columbia University Press, 1936. ($ 3.25). ISIS

This book represents a survey of conditions among the medical profession of America during the years 1783 to 1850, a transition period, as the author characterizes it, from medieval customs to modern methods. The book represents no more than a summary account of the subject with which it deals, yet in its way it is quite comprehensive, and although Dr. SHAFER, who is not a medical man, shows no very profound acquaintance with many of the figures whom he mentions, or with their works, he has, however, succeeded in giving an adequate adumbration of American medicine and medical education during this period which will be of service to those who may be interested in the period. There is a bibliography of books and manuscripts, and an index. The book is not illustrated. M. F. A.-M.

Sigerist, Henry E. An outline of the development of the hospital. *Bulletin of the institute of the history of medicine* 4, 573-81, 1936. ISIS

53. — PHARMACY—PHARMACOLOGY—TOXICOLOGY

(Berlin, Pharmaziehistorische Bibliothek). Katalog der pharmaziehistorischen Bibliothek in Berlin. Hrsg. von der Gesellschaft für Geschichte der Pharmazie. 110 p., 1 ills. (received Sept. 1936). ISIS

Fiek, Wolfgang. Die pharmaziegeschichtliche Sammlung im Thüringer Museum zu Eisenach. 49 p., 34 figs. (Gesellschaft für Geschichte der Pharmazie). Mittenwald (Bayern) NEMAYER (received Sept. 1936). ISIS

Stelljes, W. 350 Jahre Hofapotheke am Markt (Zur Geschichte der Rats- und Hofapotheke zu Eisenach). Bildschmuck von FELIX SCHUCHARD. 40 p., illus. Gesellschaft für Geschichte der Pharmazie, 1935. ISIS

VIII. — EDUCATION

(the methods of accumulating, imparting and diffusing knowledge)

54. — EDUCATION

(*Generalities, methods, colleges, universities*)

Gruenberg, Benjamin C. Light and smoke from the torch of science. *Science education* 20, 60-5, 1936. ISIS

Walsh, James J. Education of the founding fathers of the Republic: scholasticism in the colonial colleges; a neglected chapter in the history of American education. 377 p., 7 ills. New York, Fordham University Press, 1935. ISIS

Reviewed by LYNN THORNDIKE, *Isis* 25, 173-74, 1936.

58. — CATALOGUES OF SECOND-HAND BOOKS ON THE HISTORY AND PHILOSOPHY OF SCIENCE

Many catalogues of second-hand books are so interesting and so full of valuable information that we shall henceforth register them in this section, together with other lists of a similar nature, such as catalogues of scientific medals and prints. When applying to the publishers of these catalogues for a copy, please mention *Isis*.

L'Art ancien, S. A. Astronomy and astrology; early bibliography, printing, etc.; chemistry and alchemy; Chess; medicine (dentistry); natural and exact sciences; varia; witchcraft, demonology, etc. Short list 7, 56 p. Zürich, 8, Pelikanstrasse (received July 1936). ISIS

Davis and Orioli. Old medicine and science, comprising a collection of books on the history of chemistry. Catalogue 71. 39 p. London, W. C. 1, 30 Museum St. (received in June 1936). ISIS

Durtal. Livres, plaquettes rares, documents pour servir à l'histoire des sciences. Catalogue 17. 49 p., 741 items. Paris (VI), 1936. ISIS

Harrassowitz, Otto. Aegypten vom Altertum bis zur Neuzeit enthaltend u. a. die Bibliothek von Prof. Dr. W. WRESZINSKI. Bücher-Katalog 460, 150 p., 2682 items, Leipzig, 1936. ISIS

Heffer, W. India and the Near East, with sections on Hebrew, Syriac and Ethiopic literature, including several private collections. No. 484, 130 p., 2399 items. (Bibliotheca asiatica 38). Cambridge, 3-4, Petty Cury, (received June 1936). ISIS

Hoosier Bookshop. Americana medica, also fundamental texts illustrating the history of the development of medicine and miscellaneous medical works of importance. List 44. 157 items. Indianapolis, Indiana, 2242 Park Ave, (received Sept. 1936). ISIS

Junk, W. Rara historico-naturalia, vol. 2, pars 3, 191-240, s'Gravenhage, 1936. ISIS

Junk, W. Zoologia generalis. Biologia. Itinera. No. 89, 62 p. Den Haag, Scheveningsche Weg 74, 1936. ISIS

Karl and Faber. Varia, Einbände-Inkunabeln, Holzschnittbücher 16. Jahrhundert, illustrierte Werke 17.-19. Jahrhundert. Deutsche Literatur, alte Medizin und Naturwissenschaften. Katalog 65, 48 p., 543 items. Munich, 2 NW, Karolinenplatz, 1, 1936. ISIS

Lambert, Pierre. Livres, plaquettes rares, documents pour servir à l'histoire des sciences. Catalogue 17, 49 p., 740 items. Paris, VI, 12, rue Jacob, 1936. ISIS

Librairie Universitaire, S. A. Catalogue de livres d'occasion anciens et modernes à des prix très modérés. Archéologie—Egyptologie—Linguistique—Orientalisme—Religions—Philosophie, etc. N° 10, 933 items, 44 p. Paris, VI, 7, rue Danton, 1936. ISIS

Luzac. A catalogue of second-hand books. Orientalia, being recently acquired items dealing with the history, geography, etc., of the Orient. No. 33, 35 p. London, W.C. 1, 46, Great Russell St., 1936. ISIS

Maisonneuve, Adrien. Catalogue de livres anciens et modernes, rares ou curieux relatifs à l'Orient. N° 33, 98 p., 844 items. Paris, VI, 1936. ISIS

Nourry, Emile. Médecine ancienne, anatomie-chirurgie, chimie et alchimie, sciences anciennes. 84 p., 982 items. Paris (V^e^), 62, rue des Ecoles, 1936. ISIS

Quaritch, Bernard. A catalogue of books and periodicals on all classes of zoology, including a selection of books from the important entomological library of the late ROBERT ADKIN, F. R. E. S., No. 521. 88 p., 965 items. London, W. 1, 11 Grafton St., New Bond St., 1936. ISIS

Quaritch, Bernard. A catalogue of books and periodicals on botany (including many important floras) agriculture, forestry, fruit-culture, gardens and gardening herbals. No. 523, 60 p., 635 items. London, W. 1, 1936. ISIS

Quaritch, Bernard. A catalogue of books, newsbooks and pamphlets printed before 1700 relating to CHARLES I, the Civil War and the Commonwealth, 1625-1660, including a section on Irish contemporary affairs, Bibles and theology, bibliography, early medicine and surgery, early science, etc. No. 524, 136 p., 1103 items. London, W. 1, 1936. ISIS

Quereuil, J. A. L'office bibliographique. Catalogue périodique de bons livres anciens et modernes. N° 115, 52 p., 933 items. Paris, VI, 35-37, rue Bonaparte, 1936. ISIS

Sotheran, Henry. Catalogue of science and technology, No. 111. Annotated and classified list of rare and standard works on exact

and applied science. Part 12 : 14. Navigation ; naval architecture and engineering, and 15. Aeronautics. Catalogue no. 846, 1268 p., 20, 917 items. London, W. 1, 43, Piccadilly, 1936. ISIS

Stechert, G. E. STECHERT's mathematical catalogue. No. 87, 52 p., 1800 items, New York, 31 E. 10th St., 1936. ISIS

Taeuber, H. W. From FRACASTORO to GRASSI. Classics of bacteriology, catalogue 43. 16 p., 71 items. München, Barenstr. 22, (no date, received May 1936). ISIS

Wepf, B. Antiquariats-Anzeiger, no. 58 : Medizin. 16 p., 356 items. Basel, Eisengasse 5, May 1936. ISIS

59. — MEMORIA TECHNICA

Critical bibliography no. 48. *Isis*, vol. 26, 490-604, 1937. ISIS

This note is published at the end of our bibliography solely for the convenience of the scholars who cut out the whole or part of it, attach extracts to catalogue cards and classify them. By adding this note to the others they will be able to find out rapidly whether this particular bibliography has been analyzed or not.

Isis no. 69 (vol. 25, 1, 317 p., 1 pl., 2 fig., 5 facs.), 1936. ISIS

This number is analyzed in the 48th Critical Bibliography. Every previous number has been analyzed in previous bibliographies. G. S.

60. — ERRATA. Series 37

(*For previous errata see* Isis 25, 605)

Si quis Argi oculos habere posset eosque omnes diligentissime ac accuratissime intenderet in singulos versus, multa tamen eum inter corrigendum effugerent.

Introd., vol. 2, 1215 (index). Read PETER THE EATER (XII-2), not XII-1.

ISIS

Vol. 18, p. 65, n. 4. The first words of the *incipit* of the botanical work of RUFINUS should read " Cum enim Deus ineffabili misericordia." L. T.

Vol. 24, p. 594, also p. 88. In *Isis* 24, 594, is listed " SCHRECK, T. J." May I suggest that this ought to be " SCHRECK, J.," and that the same author to be listed also as " TERENTIUS, J."? The " SCHRECK (TERRENZIO) GIOVANNI " of *Isis* 24, 88, is JOHANN SCHRECK, *alias* JOANNIS TERENTIUS. (Cf. SOMMERVOGEL, ***Bibliothèque de la Compagnie de Jésus***, 7, 1928, " TERENTIUS (SCHRECK), JEAN "). My interest in TERENTIUS dates from the first time I waded through *Kepleri opera omnia*. KEPLER puts two r's in TERENTIUS (and two p's in KEPLERUS) in his " R. P. JOANNIS TERRENTII e Societate Jesu Epistolium ex Regno Sinum... cum Commentatiuncula JOANNIS KEPPLERI...," (Sagan, 1630), (reprinted by FRISCH in *Kep. op. om.*, VII, 667 ff.). W. BURKE-GAFFNEY, S. J.

Vol. 25, p. 152, l. 9 from bottom. Read *maleficarum* for *maleficorum*.

OSIRIS

Vol. 2, p. 363, l. 3. Omit " of both editions."

A few other misprints are not mentioned in these errata because they are too obvious to cause any error or confusion. I wish to express my thankfulness to the readers who take the trouble to make the abovementioned corrections in their sets of *Isis*, *Osiris*, and the *Introduction*. I would advise them, after having accomplished that little task, to write their initials near mine at the bottom of this note to indicate that these and previous errata have been taken into account.

These and the previous errata have been corrected by.....

Index of Authors Included in the Forty-eighth Bibliography

The Roman figures followed by (1) or (2) refer to the centurial classification (Part I); thus Balmer, L., XV(2) means that a paper by Balmer is listed under fifteenth century, second half.

The Arabic figures refer to the historical and to the systematic classification (Parts II and III) which are subdivided in sections numbered consecutively from 1 to 60. For instance, Bailey, T. G., 9 indicates that a paper by Bailey is listed in section 9 (India); Das, S. R., 23 indicates that a paper by Das is listed in section 23 (Astronomy).

October 1936. FRANCES SIEGEL.

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Aagaard, B., 31.
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Beekman, F., XVIII(2)D.
Behaegel, T., XVII(2)E.
Bell, E. T., XIX(2)A.
Bercher, L., 14.
Berg, C. C., 8.
Bergson, H., XIX(2)D.
Bergstrand, O., XVIII(1)D.
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